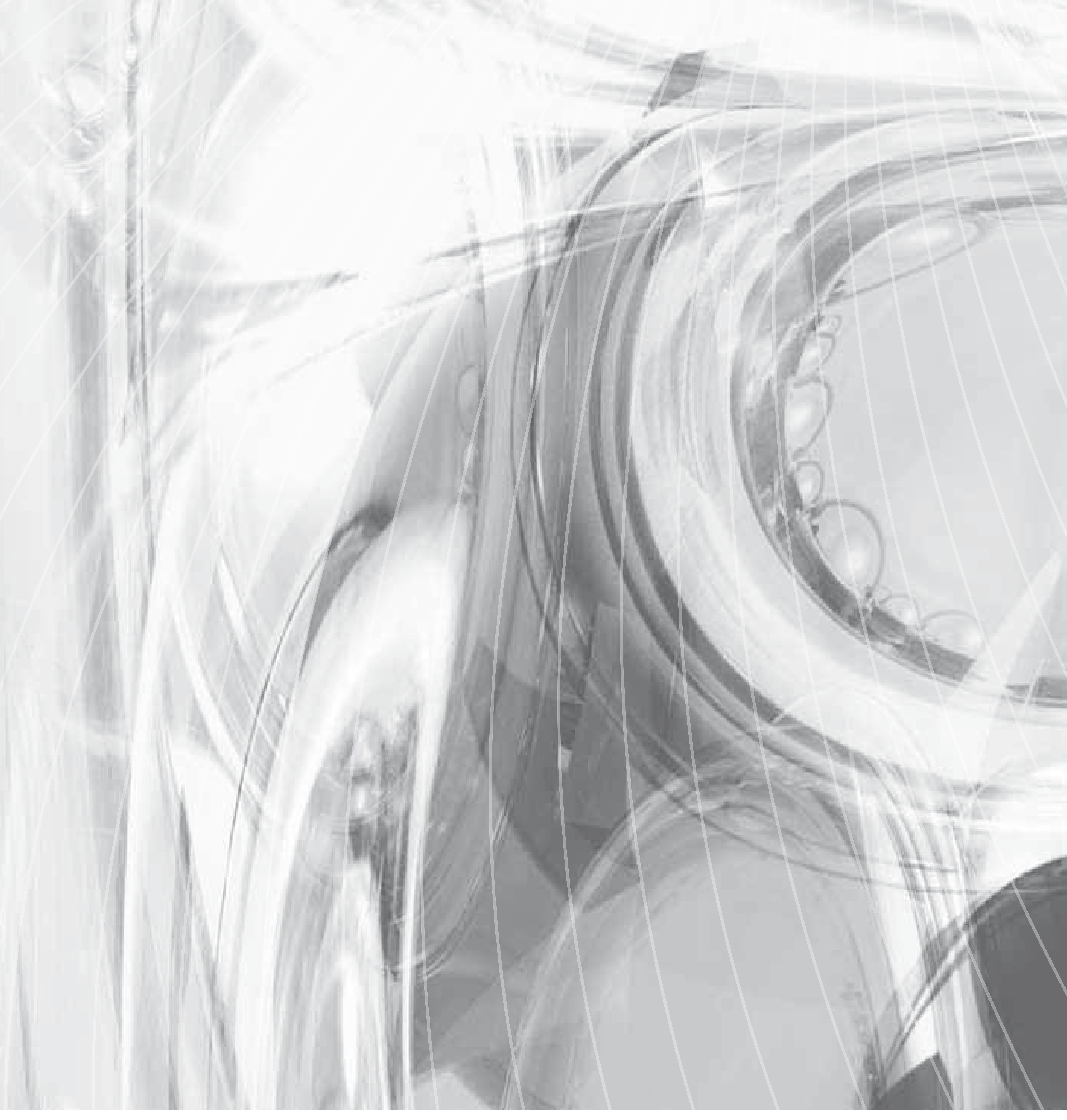
Solución a los ejercicios de álgebra



Capítulo 1

Ejercicio 1

1. $\notin$	4. $\notin$	7. $\in$	10. $\notin$
2. $\notin$	5. $\in$	8. $\notin$	11. $\notin$
3. $\in$	6. $\in$	9. $\in$	12. $\notin$

Ejercicio 2

1. $R = \{ x \in N \mid x \text{ es divisor de } 10 \}$
2. $A = \{ 2, 3, 4, 5, 6, 7, 8, 9 \}$
3. $B = \{ 4 \}$
4. $C = \{ x \in N \mid x \text{ es divisor de } 20 \}$
5. $V = \{ -2, -1, 0, 1, 2 \}$
6. $Q = \{ e, o, u \}$
7. $T = \{ 2, 3, 4, 5 \}$
8. $S = \{ 2, 3, 7 \}$
9. $U = \{ x \in N \mid x \text{ es un múltiplo de } 4 \}$
10. $M = \{ 2, 10, 50 \}$

Ejercicio 3

1. $n(A) = 8$
2. $n(B) = 1$
3. $n(S) = 4$
4. $n(R) = 0$
5. $n(Q) = \infty$
6. $n(T) = 1$
7. $n(M) = 0$
8. $n(L) = 4$
9. $n(J) = \infty$
10. $n(O) = 12$

Ejercicio 4

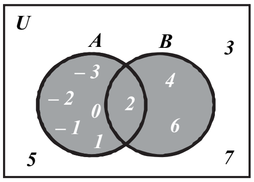
1. Iguales
2. Equivalentes y disjuntos
3. Disjuntos
4. Disjuntos
5. Equivalentes
6. Equivalentes y disjuntos
7. Equivalentes y disjuntos
8. Disjuntos
9. Disjuntos
10. Iguales

Ejercicio 5

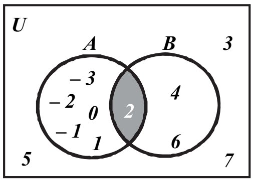
1. 8 subconjuntos
2. 32 subconjuntos
3. 16 subconjuntos
4. $\{\{\ \},\{\alpha\},\{\beta\},\{\theta\},\{\alpha,\beta\},\{\alpha,\theta\},\{\beta,\theta\},\{\alpha,\beta,\theta\}\}$
5. $\{\{\ \},\{a\},\{c\},\{e\},\{f\},\{a,c\},\{a,e\},\{a,f\},$
   $\{c,e\},\{c,f\},\{e,f\},\{a,c,e\},\{a,c,f\},\{a,e,f\},$
   $\{c,e,f\},\{a,c,e,f\}\ \}$
6. $\{\{\ \},\{1\},\{2\},\{3\},\{6\},\{1,2\},\{1,3\},\{1,6\},$
   $\{2,3\},\{2,6\},\{3,6\},\{1,2,3\},\{1,2,6\},\{1,3,6\},$
   $\{2,3,6\},\{1,2,3,6\}\ \}$
7. $\{\{\ \},\{1\},\{3\},\{9\},\{1,3\},\{1,9\},\{3,9\},\{1,3,9\}\}$
8. $\{\{\ \},\{5\},\{6\},\{7\},\{5,6\},\{5,7\},\{6,7\},\{5,6,7\}\}$

Ejercicio 6

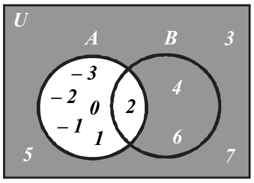
1. $A \cup B = \{ -3, -2, -1, 0, 1, 2, 4, 6 \}$



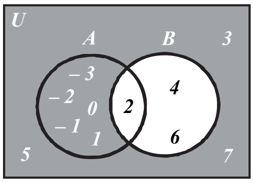
2. $A \cap B = \{ 2 \}$



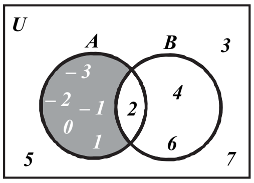
3. $A' = \{ 3, 4, 5, 6, 7 \}$



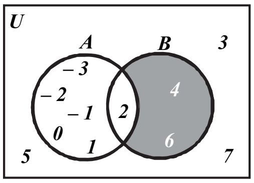
4. $B' = \{ -3, -2, -1, 0, 1, 3, 5, 7 \}$



5. $A - B = \{ -3, -2, -1, 0, 1 \}$



6. $B - A = \{ 4, 6 \}$

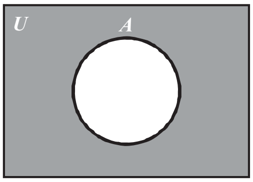


EJERCICIO 7

1. $A \cup B = \{0,1,2,3,4,6,8,12\}$
2. $B \cup C = \{0,1,2,3,4,5,6,12\}$
3. $C \cup D = \{0,1,2,3,4,5,6\}$
4. $D \cup B = \{1,2,3,4,5,6,12\}$
5. $A \cap B = \{2,4,6\}$
6. $A \cap D = \{4,6\}$
7. $C \cap E = \{0,1,2,3,4,5\}$
8. $B \cap C = \{1,2,3,4\}$
9. $A' = \{1,3,5,7,9,10,11,12,13,14,15,16,17,18\}$
10. $B' = \{0,5,7,8,9,10,11,13,14,15,16,17,18\}$
11. $C' = \{6,7,8,9,10,11,12,13,14,15,16,17,18\}$
12. $D' = \{0,1,2,7,8,9,10,11,12,13,14,15,16,17,18\}$
13. $A - B = \{0,8\}$
14. $C - D = \{0,1,2\}$
15. $E - B = \{0,5,7,8,9\}$
16. $B - A = \{1,3,12\}$
17. $A' \cap B = \{1,3,12\}$
18. $A \cup B' = \{0,2,4,5,6,7,8,9,10,11,13,14,15,16,17,18\}$
19. $B' \cap E' = \{10,11,13,14,15,16,17,18\}$
20. $A' - G = \{1,3,5,7,9,10,11,13,15,17\}$
21. $(A \cup B)' = \{5,7,9,10,11,13,14,15,16,17,18\}$
22. $(A \cap B)' = \{0,1,3,5,7,8,9,10,11,12,13,14,15,16,17,18\}$
23. $(A \cup F) \cap C = \{0,2,4\}$
24. $B \cup (F - G) = \{1,2,3,4,6,12,15,17\}$
25. $(F - G) \cap E' = \{15,17\}$
26. $(F \cap G) \cup D = \{3,4,5,6,14,16,18\}$
27. $E' \cap (A \cup G) = \{12,14,16,18\}$
28. $(E \cup F) \cap (A \cup G) = \{0,2,4,6,8,14,16,18\}$
29. $(C \cup E) \cap (F \cup G) = \{\ \} = \phi$
30. $(B \cup D) \cup (F \cap G) = \{1,2,3,4,5,6,12,14,16,18\}$
31. $(B \cup D)' - (E \cup G)' = \{0,7,8,9,14,16,18\}$
32. $(A' \cap B') - (E' \cap F') = \{5,7,9,14,15,16,17,18\}$

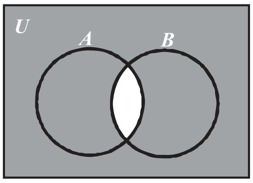
EJERCICIO 8

1.



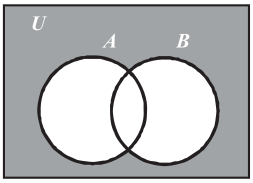
A'

2.



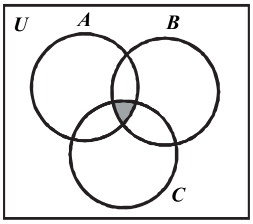
$(A \cap B)'$

3.



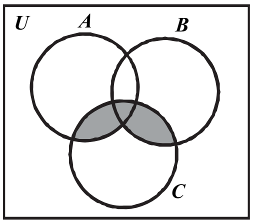
$A' \cap B'$

4.



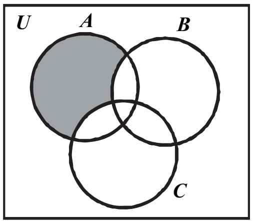
$A \cap B \cap C$

5.



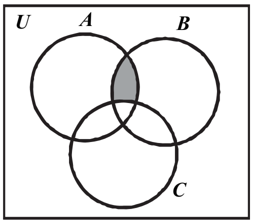
$(A \cup B) \cap C$

6.



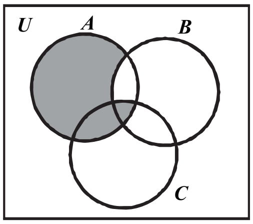
$B' \cap (A - C)$

7.



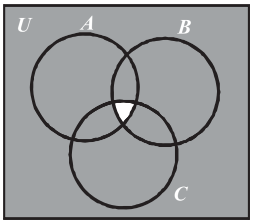
$(A \cup C) \cap (B - C)$

8.



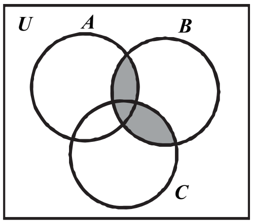
$(A - B) \cup (A \cap C)$

9.



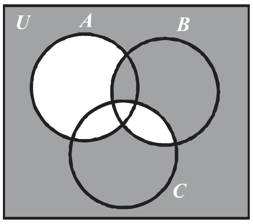
$(A \cap B \cap C)'$

10.



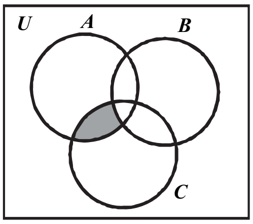
$(A \cap B) \cup (B \cap C)$

11.



$((A - B) \cup (B \cap C))'$

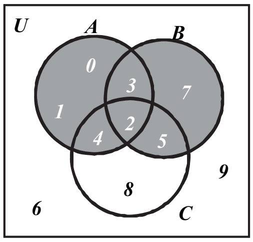
12.



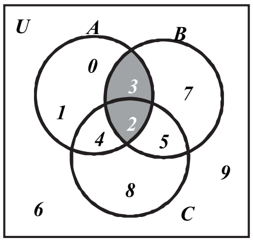
$(A' \cup B') - (A' \cup C')$

EJERCICIO 9

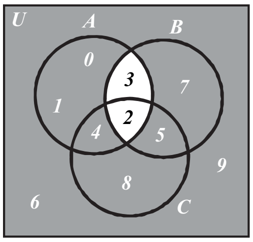
1. $A \cup B = \{0,1,2,3,4,5,7\}$



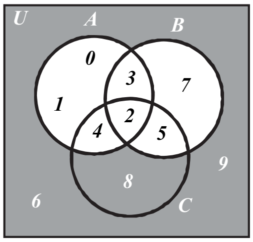
2. $A \cap B = \{2,3\}$



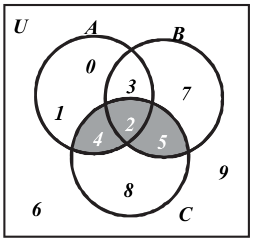
3. $A' \cup B' = \{0,1,4,5,6,7,8,9\}$



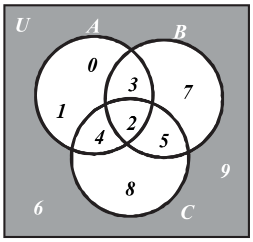
4. $A' \cap B' = \{6, 8, 9\}$



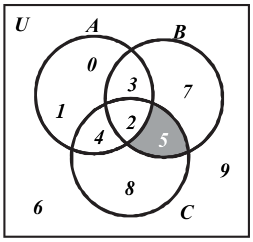
5. $(A \cup B) \cap C = \{2, 4, 5\}$



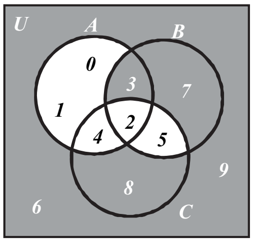
6. $(A \cup B \cup C)' = \{6, 9\}$



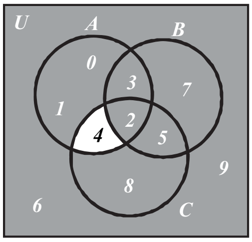
7. $(A' - B') \cap C = \{5\}$



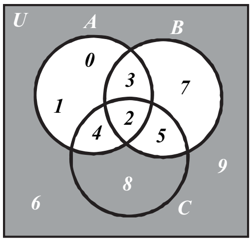
8. $(A - B)' \cap (B \cap C)' = \{3, 6, 7, 8, 9\}$



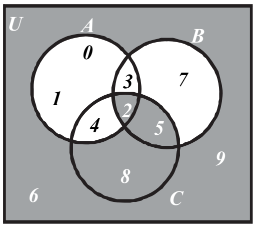
9. $(A - B)' \cup C' = \{0, 1, 2, 3, 5, 6, 7, 8, 9\}$



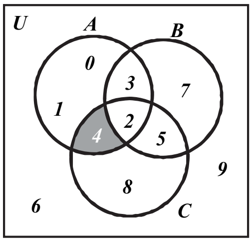
10. $(A \cap B)' \cap (A' \cap B') = \{6, 8, 9\}$



11. $(A - B)' \cap (B - C)' = \{2, 5, 6, 8, 9\}$

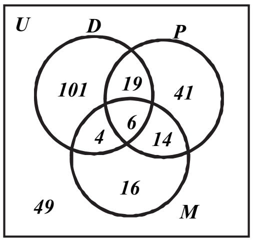


12. $(A' \cup B') - (A' \cup C') = \{4\}$



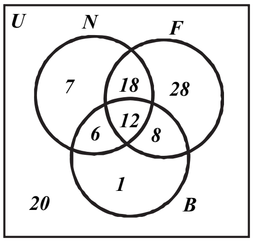
EJERCICIO 10

1.



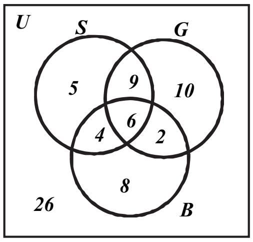
a) 101 personas
b) 158 personas
c) 100 personas

2.



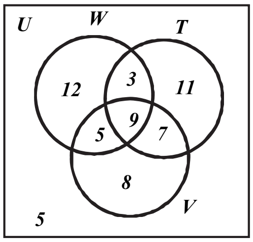
a) 52 niños
b) 73 niños
c) 100 niños
d) 32 niños

3.



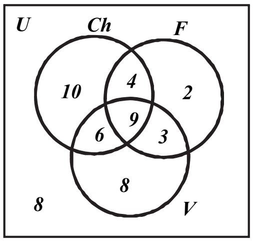
a) 8 personas
b) 5 personas
c) 10 personas
d) 26 personas
e) 34 personas
f) 36 personas

4.



a) 5 personas
b) 15 personas
c) 55 personas
d) 31 personas

5.



a) 50 niños
b) 13 niños
c) 20 niños
d) 16 niños

EJERCICIO 12

1. "España está en Europa y Japón está en Asia"
2. "España está en Europa o Japón está en Asia"
3. "España no está en Europa"
4. "Japón no está en Asia"
5. "Si España está en Europa, entonces Japón está en Asia"
6. "España está en Europa, si y sólo si Japón está en Asia"
7. "España no está en Europa y Japón está en Asia"
8. "España está en Europa o Japón no está en Asia"
9. "No es verdad que España está en Europa o Japón está en Asia"
10. "No es verdad que España está en Europa y Japón está en Asia"

EJERCICIO 13

1. $a \wedge b$
2. $a \wedge \sim b$
3. $\sim a \vee \sim b$
4. $b \vee a$
5. $\sim a \wedge b$
6. $\sim(a \wedge b)$

EJERCICIO 14

1. $\sim a$ = "España no está en Europa y 6 no es número par"
2. $\sim b$ = "Los perros no ladran o 12 no es múltiplo de 3"
3. $\sim c$ = "5 no es número par o es múltiplo de 15"
4. $\sim d$ = "7 es primo y no es divisor de 21"
5. $\sim e$ = "6 es número impar o el tucán es un ave"

EJERCICIO 15

1.

Conversa:
"Si 3 no es par, entonces es divisor de 6"
Contrapositiva:
"Si 3 es par, entonces no es divisor de 6"
Inversa:
"Si 3 no es divisor de 6, entonces es par"

2.

Conversa:
"Si x es divisor de 25, entonces es múltiplo de 5"
Contrapositiva:
"Si x no es divisor de 25, entonces no es múltiplo de 5"
Inversa:
"Si x no es múltiplo de 5, entonces no es divisor de 25"

3.

Conversa:
"Si un triángulo no es un cuadrilátero, entonces es un polígono"
Contrapositiva:
"Si un triángulo es un cuadrilátero, entonces no es un polígono"
Inversa:
"Si un triángulo no es un polígono, entonces es un cuadrilátero"

4.

Conversa:
"Si la Luna es un satélite, entonces Marte no es un planeta"
Contrapositiva:
"Si la Luna no es un satélite, entonces Marte es un planeta"
Inversa:
"Si Marte es un planeta, entonces la Luna no es un satélite"

5.

Conversa:

"Si 17 no es múltiplo de 50, entonces es número primo"

Contrapositiva:

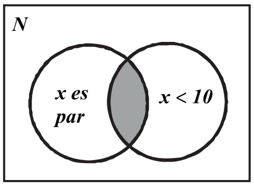
"Si 17 es múltiplo de 50, entonces no es número primo"

Inversa:

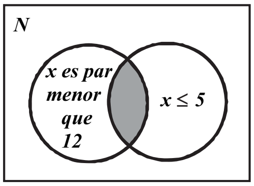
"Si 17 no es número primo, entonces es múltiplo de 50"

Ejercicio 16

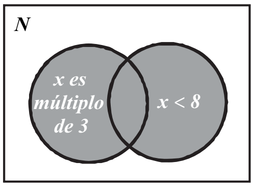
1. $\{2,4,6,8\}$



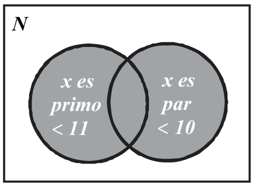
2. $\{2,4\}$



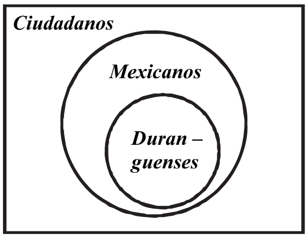
3. $\{1,2,3,4,5,6,7,9,12,15,18,...\}$



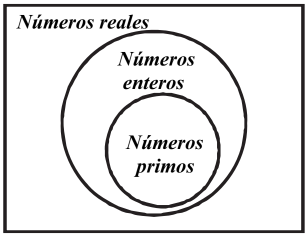
4. $\{2,3,4,5,6,7,8\}$



5.

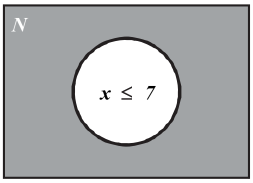


6.



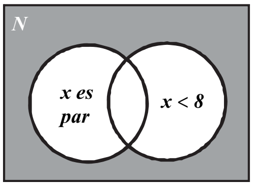
7. $\sim g$ = "$x \nleq 7$"; $x \in N$

$\sim g$ = "$x > 7$"; $x \in N$



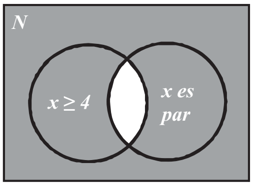
8. $\sim h$ = "x no es par y $x \nless 8$"; $x \in N$

$\sim h$ = "x no es par y $x \geq 8$"; $x \in N$



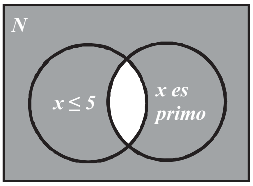
9. $\sim i$ = "$x \ngeq 4$ o x no es par"; $x \in N$

$\sim i$ = "$x < 4$ o x no es par"; $x \in N$



10. $\sim j$ = "$x \nleq 5$ o x no es primo"; $x \in N$

$\sim j$ = "$x > 5$ o x no es primo"; $x \in N$



Ejercicio 17

1. Falso 2. Falso 3. Falso 4. Verdadero 5. Verdadero 6. Verdadero

Ejercicio 18

1.

p	q	$\sim q$	$p \vee \sim q$
v	v	f	v
v	f	v	v
f	v	f	f
f	f	v	v

2.

p	q	$\sim q$	$p \wedge \sim q$
v	v	f	f
v	f	v	v
f	v	f	f
f	f	v	f

3.

p	q	$\sim p$	$\sim q$	$\sim p \Rightarrow \sim q$
v	v	f	f	v
v	f	f	v	v
f	v	v	f	f
f	f	v	v	v

4.

p	q	$p \vee q$	$\sim(p \vee q)$	$\sim q$	$\sim(p \vee q) \Rightarrow \sim q$
v	v	v	f	f	v
v	f	v	f	v	v
f	v	v	f	f	v
f	f	f	v	v	v

5.

p	q	$p \wedge q$	$p \vee q$	$(p \wedge q) \Leftrightarrow (p \vee q)$
v	v	v	v	v
v	f	f	v	f
f	v	f	v	f
f	f	f	f	v

6.

p	q	$p \vee q$	$p \Rightarrow q$	$\sim(p \Rightarrow q)$	$(p \vee q) \wedge \sim(p \Rightarrow q)$
v	v	v	v	f	f
v	f	v	f	v	v
f	v	v	v	f	f
f	f	f	v	f	f

7.

p	q	$p \Rightarrow q$	$q \Rightarrow p$	$(p \Rightarrow q) \vee (q \Rightarrow p)$
v	v	v	v	v
v	f	f	v	v
f	v	v	f	v
f	f	v	v	v

8.

p	q	$p \Rightarrow q$	$p \wedge (p \Rightarrow q)$	$(p \wedge (p \Rightarrow q)) \Rightarrow p$
v	v	v	v	v
v	f	f	f	v
f	v	v	f	v
f	f	v	f	v

9.

p	q	$\sim p$	$\sim q$	$\sim p \wedge \sim q$	$p \vee q$	$\sim(p \vee q)$	$(\sim p \wedge \sim q) \Rightarrow \sim(p \vee q)$
v	v	f	f	f	v	f	v
v	f	f	v	f	v	f	v
f	v	v	f	f	v	f	v
f	f	v	v	v	f	v	v

10.

p	q	r	$p \vee q$	$p \vee r$	$(p \vee q) \wedge (p \vee r)$
v	v	v	v	v	v
v	v	f	v	v	v
v	f	v	v	v	v
v	f	f	v	v	v
f	v	v	v	v	v
f	v	f	v	f	f
f	f	v	f	v	f
f	f	f	f	f	f

11.

p	q	r	$\sim p$	$\sim q$	$(\sim q \Leftrightarrow r)$	$\sim p \vee (\sim q \Leftrightarrow r)$
v	v	v	f	f	f	f
v	v	f	f	f	v	v
v	f	v	f	v	v	v
v	f	f	f	v	f	f
f	v	v	v	f	f	v
f	v	f	v	f	v	v
f	f	v	v	v	v	v
f	f	f	v	v	f	v

EJERCICIO 19

1. $A \times B = \{(1,2),(1,4),(2,2),(2,4),(3,2),(3,4)\}$
2. $A \times C = \{(1,3),(1,5),(1,6),(2,3),(2,5),(2,6),(3,3),(3,5),(3,6)\}$
3. $B \times C = \{(2,3),(2,5),(2,6),(4,3),(4,5),(4,6)\}$
4. $B \times A = \{(2,1),(2,2),(2,3),(4,1),(4,2),(4,3)\}$
5. $C \times B = \{(3,2),(3,4),(5,2),(5,4),(6,2),(6,4)\}$
6. $A \times (B \times C) = \{(1,2,3),(1,2,5),(1,2,6),(1,4,3),(1,4,5),(1,4,6)$ $(2,2,3),(2,2,5),(2,2,6),(2,4,3),(2,4,5),(2,4,6)$ $(3,2,3),(3,2,5),(3,2,6),(3,4,3),(3,4,5),(3,4,6)\}$
7. $(A \times B) \times C = \{(1,2,3),(1,2,5),(1,2,6),(1,4,3),(1,4,5),(1,4,6)$ $(2,2,3),(2,2,5),(2,2,6),(2,4,3),(2,4,5),(2,4,6)$ $(3,2,3),(3,2,5),(3,2,6),(3,4,3),(3,4,5),(3,4,6)\}$
8. $(A \cup B) \times (A \cap C) = \{(1,3),(2,3),(3,3),(4,3)\}$
9. $(A - B) \times C = \{(1,3),(1,5),(1,6),(3,3),(3,5),(3,6)\}$
10. $(A - C) \times (A \cap C) = \{(1,3),(2,3)\}$

CAPÍTULO 2

EJERCICIO 20

1. $-5x$	10. $2n$	19. $a^2b - ab^2$
2. $13a^2b$	11. $-\frac{11}{60}a^3b$	20. $a^3b^2c - 2a^2bc^2$
3. $-10xy^2$	12. 0	21. $7x^2 - 10y^2 + 8$
4. 0	13. $0.05b = \frac{1}{20}b$	22. $-8m^2 + 4mn + 5n^2$
5. $10a^2b$	14. $-2ab^3c$	23. $2x^{2a+1} + 5x^{3a-2}$
6. $-8a$	15. $-3m^{x-2}$	24. $-9a^{m+5} + 7x^{m+2}$
7. $-x$	16. $-3x + 3y$	25. $-\frac{15}{4}a^2 + 3ab$
8. $8ab$	17. b	26. $-\frac{17}{6}x^{m-1} - \frac{17}{20}b^{m-2}$
9. $-a^2$	18. $-11m - 8n$	27. $\frac{1}{2}x - 3y$

EJERCICIO 21

1. -1	10. $\frac{1}{36}$	16. $\frac{7}{3}$	21. $\frac{5}{12}$
2. 5	11. $\frac{49}{144}$	17. 2	22. $\frac{285}{16}$
3. 3	12. 31	18. $\frac{11}{12}$	23. $-\frac{1}{156}$
4. 1	13. $-\frac{65}{4}$	19. $-\frac{23}{4}$	24. 432
5. 14	14. 24	20. $-\frac{9}{64}$	25. $\frac{33}{2}$
6. $\frac{7}{12}$	15. $-\frac{105}{8}$		
7. -2			
8. -6			
9. 24			

EJERCICIO 22

1. $x - 3$
2. $3a + 8$
3. $\frac{x}{y}$
4. $100 - x$
5. $x, x + 1$
6. $2a,\ 2a + 2,\ 2a + 4$ con $a \in Z$
7. $(x + y)^2$
8. $x^2 + y^2$
9. $\frac{1}{x}$
10. $\sqrt[3]{x - y}$
11. $\sqrt{a} + \sqrt{b}$
12. $5x - 10$
13. $\frac{a + b}{6}$
14. $2x + (2x + 2) + (2x + 4) = 3(2x) + \frac{3}{4}(2x + 4)$
15. $2y(10) + y = 21y$
16. $\frac{1}{4}xyz - 4$
17. $(a + b)^2 = 49$
18. $A = x^2$
19. $P = 2(3a + a) = 2(4a) = 8a$
20. $x + (x + 3) + (x + 5) = P$
21. $x - 0.15x = 0.85x$
22. $50 - 2x$
23. $x, 80 - x$
24. $2x + 1,\ 2x + 3,\ 2x + 5$ con $x \in Z$
25. $A = x(3x - 3)$
26. $x - 10$
27. $x^3 - \frac{x}{2}$
28. $x, 2x, 180° - 3x$
29. $0.30x$
30. $2x + 4$
31. $\frac{2}{3}x + 3(x + 1) - \frac{1}{x} = 10$
32. $2x = 3(x - 1) + 7$

EJERCICIO 23

1. Un número aumentado en tres unidades.
2. El doble de un número disminuido en once unidades.
3. El triple del cuadrado de un número.
4. Las cinco sextas partes de un número cualquiera.
5. El recíproco de un número.
6. El cuadrado de la suma de dos cantidades diferentes.
7. La suma de los cubos de dos números.
8. El cociente de un número entre su consecutivo.
9. El quíntuplo de un número equivale a treinta unidades.
10. El triple de un número disminuido en dos unidades equivale a veinticinco.

11. Las tres cuartas partes de un número aumentado en dos unidades equivalen a dicho número.
12. Una sexta parte de la diferencia de dos cantidades aumentada en tres unidades equivale a la suma de dichos números.
13. El cociente de dos números equivale a un quinto de su diferencia.
14. La diferencia de los cuadrados de dos cantidades.
15. La diferencia del cuadrado de un número con el doble del mismo.
16. El cuadrado de la semisuma de dos cantidades.
17. La raíz cuadrada del cociente de la suma de los números entre la diferencia de ellos.
18. La suma de los cuadrados de dos números enteros consecutivos.

Ejercicio 24

1. $10x - 5y - z$
2. $-3m - n - 2$
3. $3a - b$
4. $-7p + 2q - 7r$
5. $5x^2 + 10x + 2$
6. $-2a^3 + 9a^2 - 5$
7. $2x^4 + x^3 + 2x^2 - x$
8. $x^2 - 2x$
9. $5y^3 - 3y^2 - 3y - 1$
10. $2z^3 + 7z^2 - 7z - 1$
11. $-9x^2 + 3xy - 11y^2$
12. $x^5 + x^4 - x^3 + 6x^2 - 3x - 2$
13. $-23x^3y - x^2y^2 - 10xy^3$
14. $4x^4 - xy^3 - 4y^4$
15. $-4a^7 + 3a^6 + 6a^4 - a^2 + 7a$
16. $\frac{1}{6}x^2 - 3xy - \frac{1}{3}y^2$
17. $\frac{1}{3}a^2 + \frac{13}{12}ab - \frac{7}{24}b^2$
18. $\frac{5}{3}x^3 - \frac{1}{3}x^2y - \frac{1}{8}xy^2 - 2y^3$
19. $\frac{1}{3}x^3 + x^2 - \frac{5}{2}x - \frac{17}{6}y$
20. $x^5 + \frac{13}{5}x^4y - \frac{3}{10}x^3y^2 - \frac{5}{6}x^2y^3 - \frac{3}{4}xy^4 - \frac{29}{18}y^5$
21. $\frac{1}{6}x^4 + \frac{1}{4}x^3 - \frac{1}{3}x^2 - \frac{1}{4}x + \frac{1}{4}$
22. $3a^{3x} + 2a^{2x} + a^x$
23. $x^{2a} + x^{2a-2}$
24. $-\frac{7}{8}b^{2x} + \frac{1}{6}b^x + \frac{7}{3}b$
25. $\frac{2}{3}x^{1-y} + \frac{1}{12}x^{1-2y} - \frac{1}{3}x^{1-3y}$

Ejercicio 25

1. $-3a^2 + 2a - 5$
2. $x^3 - 5x^2 - 10x + 11$
3. $-5a^5 + 4a^4 - 7a^3 + 2a^2 - 9a - 1$
4. $15x^4y - 17x^2y^3 - 5xy^4$
5. $-a^5b - 4a^4b^2 - 2a^3b^3 + 5ab^5 - 1$
6. $-x^{a+2} - 13x^{a+1} - x^a + 12x^{a-1}$
7. $10a^{2m-1} - 6a^{2m} - 5a^{m+1} + a^{m-3}$
8. $x^3 + \frac{9}{4}x^2 - \frac{16}{3}x + \frac{5}{3}$
9. $\frac{2}{3}m^4n + \frac{3}{5}m^3n^2 - \frac{4}{3}m^2n^3 - 2mn^4$
10. $-\frac{5}{2}x^4 + \frac{14}{5}x^3y - \frac{4}{15}x^2y^2 - \frac{1}{3}y^4$
11. $-3x + 7y + 5$
12. $2a - 2$
13. $18x^3 - 18x^2 + 5x + 1$
14. $2a^4 - 2a^2 - a + 5$
15. $-4x^7y^5 - 6x^6y^4 + 12x^3y^2$
16. $4m^{x+1} + 2m^{x-2} + m^{x-5} - 3m^{x-6} - 4m^{x-9}$
17. $-15a^{n+10} + 4a^{n+9} - 5a^{n+2} + 3a^{n+1} - 8a^n + 5a^{n-3}$
18. $\frac{1}{2}m - \frac{7}{10}n + \frac{5}{6}p$
19. $\frac{5}{6}x^3 - \frac{5}{4}x^2y + \frac{1}{2}xy^2 - \frac{5}{12}y^3$
20. $-\frac{17}{2}a^5b + \frac{23}{4}a^4b^2 + \frac{15}{4}a^3b^3 + \frac{1}{2}a^2b^4$

Ejercicio 26

1. $8x + y$
2. $-11a + 3b + 2c$
3. $-23x + 3y$
4. $23m - 14n$
5. $-12a + 2b$
6. $-18x + 7y$
7. $19x^2 + 4x - 12y$
8. $-2x - 20y$
9. $-5x - 2y + 18z$
10. $-5x + 5y - 8z$
11. $2a - \frac{9}{10}b$
12. $\frac{14}{15}x + \frac{17}{15}y$

Ejercicio 27

1. $-15x^2$
2. $24x^8y^9z^2$
3. $-14a^9bc^8$
4. $-\frac{3}{10}xyz^5$
5. $50m^8p^4$
6. $-3c^{11}m^{10}p^2$
7. $-x^2y^2z^2$
8. $-4a^4bc$
9. m^5n^2p
10. $\frac{7}{6}a^8b^{13}c^3$
11. $-\frac{12}{35}x^3y^2z^4$
12. $-27m^7p^3$

13. $0.1m^8np^5$
14. $0.048abcxyz$
15. $-10a^{m+2}b^{n+3}c^2$
16. $-42m^{3x+2}n^{4x+5}$
17. $-36x^{3m+5}y^{2n+5}$
18. $6x^{5a-2}y^{9a-5}$
19. $\frac{1}{4}a^{5x-2}b^{2x+1}c^{x+4}$
20. $-2x^{a+1}y$
21. $-30a^6b^3c$
22. $-56x^9y^8z^2$
23. $30xyz$
24. $48x^{11}y^8$
25. $\frac{8}{3}a^{12}b^5c^4$
26. $-\frac{1}{2}a^9b^4c^4$
27. $40a^{6x+4}b^{3x+3}c^{x+2}$
28. $-\frac{1}{12}x^{4a+2}y^{7a+1}$
29. $24x^{9a-2}y^{6a+1}$
30. $20a^{8x+2}b^6m^{2x+3}n^{5x+3}$

EJERCICIO 28

1. $8a^5b-14a^4b^2$
2. $-15m^5+9m^4-18m^2+9m$
3. $3x^4y-7x^3y-2x^2y$
4. $-6a^3b+21a^2b^2-24ab^3$
5. $24a^8b^4-28a^7b^5+16a^6b^7$
6. $-35x^7y^4z^2+15x^6y^3z+20x^2y^2z^2$
7. $40m^4np^3-24m^5p^4+48m^3p^3$
8. $-12a^4c^5+21a^3bc^4+6ac^5$
9. $15m^{x+7}n^{2x+1}-9m^{x+2}n^{2x+4}+6m^{x+2}n^{2x+1}$
10. $-14x^{a+3}-12x^{a+1}+16x^a+18x^{a-1}-4x^{a-2}$
11. $-9a^{3x+2}b^{3x+1}+21a^{3x+1}b^{3x+2}+12a^{2x+1}b^{2x+2}$
12. $-25x^{5m}y^{3n+1}+10x^{5m+1}y^{3n+2}+20x^{5m+2}y^{3n+3}$
13. $-12a^{x+5}b^{y+2}c^{m+5}+12a^{x+4}b^{y+3}c^7-8a^xb^{y+1}c^6$
14. $\frac{1}{3}a^3b^2-\frac{1}{2}a^2b^3-\frac{2}{5}ab^4$
15. $x^5y+8x^4y^2-\frac{4}{9}x^3y^3$
16. $\frac{8}{25}a^7b^2c-\frac{14}{5}a^5b^4c+\frac{32}{25}a^3b^6c-\frac{1}{20}ab^3c$
17. $-4a^{6m+4}b^{2m}c^4+\frac{35}{2}a^{m+6}c^{m+4}$
18. $-3x^{2m-3}+x^{2m-2}-\frac{3}{2}x^{2m-1}$
19. $\frac{28}{3}a^{m+1}b^{3n+1}c+\frac{16}{5}a^mb^{3n+3}$
20. $-\frac{16}{15}m^{3x+3}n^{3a+4}+m^{3x+2}n^{3a+3}+\frac{14}{5}m^{3x}n^5$

EJERCICIO 29

1. $x^2-5x-14$
2. m^2+m-72
3. x^2-5x+6
4. $3x^2+19x+28$
5. $6x^2-11x-10$
6. $25x^2-16y^2$
7. $9x^2+3xy-2y^2$
8. n^4-3n^2-28
9. $\frac{1}{2}x^2-\frac{7}{3}x-4$
10. $\frac{10}{9}x^2-\frac{16}{3}xy+\frac{3}{2}y^2$
11. $\frac{4}{15}x^2-\frac{31}{30}xy-\frac{3}{4}y^2$
12. $x^3-3x^2y+3xy^2-y^3$
13. $x^3+3x^2y+3xy^2+y^3$
14. m^3+n^3
15. m^3-n^3
16. $15x^3-22x^2y-13xy^2+14y^3$
17. $-27a^3+51a^2b+40ab^2-28b^3$
18. $4a^4-2a^3-6a^2+11a-4$
19. $15x^5-20x^4-9x^3+12x^2-18x+24$
20. x^4-3x^3+3x-1
21. $\frac{2}{15}a^3-\frac{27}{10}a^2b+\frac{193}{18}ab^2-\frac{7}{6}b^3$
22. $10x^3-\frac{23}{6}x^2y+\frac{21}{20}xy^2-\frac{1}{15}y^3$
23. $-x^3+\frac{13}{30}x^2y+\frac{63}{40}xy^2-\frac{1}{2}y^3$
24. $m^x-m^{x-1}n-mn^{a-1}+n^a$
25. $b^{m+3}+b^m$
26. $x^{2m+5}+2x^{2m+4}-3x^{2m+3}-4x^{2m+2}+2x^{2m+1}$
27. $x^{2a+3}+4x^{2a+2}+x^{2a+1}-2x^{2a}$
28. $6x^4-31x^3+43x^2-6x-8$
29. $-18x^4-25x^2-14x-9$
30. $4x^5y-6x^4y^2-2x^2y^4-12xy^5$
31. $m^2-2mp-n^2+p^2$
32. $-2m^2+5mn-mp-3n^2-np+10p^2$
33. $a^2-b^2+2bc-c^2$
34. $x^6-2x^5-x^4+4x^3-4x+2$
35. $3x^4-11x^3+20x^2-7x-5$
36. $-x^{2m+4}+2x^{2m+3}-x^{2m+2}+x^{2m}$
37. $2x^{2m+3}+7x^{2m+2}+7x^{2m+1}+x^{2m}-x^{2m-1}$
38. $a^6-2a^4b^2-4a^2b^4+7ab^5-2b^6$
39. $m^{a+2}-2m^a+8m^{a-1}-3m^{a-2}$
40. $30x^{5a+1}+34x^{5a}-31x^{5a-1}-23x^{5a-2}+3x^{5a-3}$
41. $m^6+2m^5-2m^4-3m^3+2m^2-m-1$
42. $\frac{1}{9}x^5+\frac{1}{4}x^4-\frac{55}{72}x^3-\frac{17}{12}x^2+\frac{55}{48}x+\frac{3}{2}$
43. $-a^{2x+3}+2a^{2x+2}+2a^{2x+1}-4a^{2x}-a^{2x-1}+a^{2x-2}$
44. $a^{2x+6}+a^{2x+5}+5a^{2x+4}+4a^{2x+3}-a^{2x+2}-5a^{2x+1}-5a^{2x}$

EJERCICIO 30

1. $3a^4b^5$
2. $-6x^4$
3. $2a^5b^3$
4. $-4p^2q^4$
5. $-3a^8b$
6. $5a^6b^6$
7. $-\frac{1}{3}x^4y^2$
8. $-\frac{2}{3}a^2b^6$
9. $\frac{2}{3}x^2z$
10. $\frac{1}{4}xy^3z$
11. $-2x^{7a-6}y^{3b-3}$
12. $5a^{n-6}b^{2n+7}$
13. $-3a^{x+2}b^{x+3}c^{x-3}$
14. $\frac{10}{3}x^{5m-5}y^{9n-5}z^{2m-2}$
15. 1
16. $\frac{7}{20}ac^2$
17. $\frac{3}{4}a$
18. $-4xy^5$
19. $\frac{7}{6}a^{m-1}b^{n-2}$
20. $\frac{1}{9}x^4y^5$
21. $-9n^4p$
22. $-\frac{1}{2}c^3d^{5-x}$
23. $2a^3b^2$
24. $\frac{9}{8}a^{4m-1}b^{2n-2}$

EJERCICIO 31

1. $x+2$
2. $2x+1$
3. $-5x+2y$
4. $2x^2-x+1$
5. x^2+3x-4
6. $-2x^4+\frac{5}{2}x^2+3x$
7. $9m^3n^4-5m^2n^4+1$
8. $4a^6b^2+6a^5b-\frac{1}{8}a^3$
9. $4x^7y^5-7x^5y^2-1$
10. $\frac{1}{2}a-5$
11. $\frac{1}{30}a^2b^5-\frac{1}{24}ab^3-\frac{1}{6}b^2$
12. $-\frac{1}{3}a^7b^5+2a^5b^4-\frac{2}{9}a^3b$
13. $\frac{9}{4}x^6y^4-\frac{5}{2}x^7y^2+5x^3$
14. $-\frac{5}{36}x^4y^4+\frac{10}{9}x^2y^2-\frac{5}{18}xy^7$
15. $-\frac{1}{5}x^8y^5+\frac{4}{15}x^6y^4-\frac{1}{20}x^3y^3+\frac{2}{5}xy^2$
16. $2+12a^xb^yc^z-16a^{2x}b^{2y}c^{2z}$
17. $\frac{1}{6}x^{a-3}y^{12}-2x^4y^{1-a}$
18. $-4a^{3m+2}b^{3m}+3a^{2m+7}b^{2m-6}-2a^{m+1}b^{m-1}$
19. $-2a^{4m-6}b^{n+10}+5a^{5m-4}b^{n-1}-\frac{4}{5}a^{3m-2}b^{5-2n}$
20. $9x^{2a}y^bz^3+2x^{2a-1}y^{b-1}z^{c+2}-4x^{2a-2}y^{b-3}z^{c+3}$

EJERCICIO 32

1. $x+2$
2. $x+1$
3. $x+3y$
4. $x+3$
5. $x-6$
6. $x+6$
7. $m-4n$
8. $x-10y$
9. n^2-6
10. m^3+4
11. x^4+2
12. x^6-7
13. $3x-7$
14. $4m-3$
15. $5a-7$
16. $2a+3b$
17. $7m-3$
18. $3a+4b$
19. $7m-3n$
20. $3x-2y$
21. $3m^2-5n^2$
22. $3m^2+5$
23. $5m^3-6$
24. $5m^2-3m-2$
25. $3x^2+7x-6$
26. $2a-7$
27. x^2+xy+y^2
28. $4x^2-6xy+9y^2$
29. $x^4+2x^2y^2+4y^4$
30. a^3+a^2+a
31. $x-4$
32. $2x^2+xy+3y^2$
33. $3x^2+x-2$
34. $3x^2-x+1$
35. $2x^2-3x-1$
36. $2x^2-3x-5$
37. $4a^2-6a-7$
38. $6x^2-3x-4$
39. $7x^2+x-4$
40. $5x^2-9x-3$
41. $4x^2+3x-1$
42. $5a^3-3a^2b-6ab^2-2b^3$
43. $4x^5-6x^4-7x^3-8x^2-3x+2$
44. $\frac{5}{3}a+\frac{1}{2}b$
45. $4x-\frac{1}{5}y$
46. $4m-\frac{1}{3}n$
47. $\frac{1}{4}a+\frac{2}{3}$
48. $x^{a+2}-x^{a+1}+x^a$
49. $a^{m-1}-b^{y-1}$
50. $m^a-2m^{a-1}+m^{a-2}$
51. $m^{x+2}+3m^{x+1}-2m^x$
52. $m^{x+2}+2m^{x+1}-m^x$
53. $-5m^{2x+2}+m^{2x+1}+3m^{2x}$
54. $x^{m+4}-x^{m+3}-2x^{m+2}+x^{m+1}$

EJERCICIO 33

1. $6t^2-t+6$
2. $x^2+2x+4\,400$
3. $5x^2+6xy+y^2$
4. $15y^2+14y+3$
5. $20x^2-7xy-6y^2$
6. $12w^3-8w^2-13w-3$
7. $4x+y$
8. $6t^4+t^3+7t^2-2$
9. $40x^2+36x+8$
10. $9x^2-1$
11. $15x^2+4x-3$
12. $20x^2-3x-9$

Capítulo 3

Ejercicio 34

1. $x^2 + 16x + 64$
2. $m^2 - 20m + 100$
3. $a^2 - 6a + 9$
4. $y^2 + 2y + 1$
5. $y^2 + 10y + 25$
6. $p^2 - 12p + 36$
7. $1 - 2b + b^2$
8. $x^2 - 10x + 25$
9. $4 + 4n + n^2$
10. $16 - 8m + m^2$
11. $y^2 + 18y + 81$
12. $x^2 - 24x + 144$
13. $p^2 + 30p + 225$
14. $4a^2 - 4a + 1$
15. $\frac{25}{16}x^2 - \frac{5}{6}x + \frac{1}{9}$
16. $9a^2x^2 - 6ax + 1$
17. $m^2n^2 + 16amn + 64a^2$
18. $49a^2 - 42ab + 9b^2$
19. $4x^2 + 12xy + 9y^2$
20. $x^2 + 0.4x + 0.04$
21. $16x^6 + 40x^3y + 25y^2$
22. $81a^6 - 18a^5b + a^4b^2$
23. $36m^2n^8 + 36m^6n^4p + 9m^{10}p^2$
24. $a^{10} - 2a^5b^5 + b^{10}$
25. $1 - \frac{3}{2}xy + \frac{9}{16}x^2y^2$
26. $\frac{1}{16}x^2 - xy^3 + 4y^6$
27. $\frac{4}{9x^2} - \frac{1}{3xy} + \frac{1}{16y^2}$
28. $9x^4 + 24x^3y^7 + 16x^2y^{14}$
29. $25a^2b^2 - 30abxy^5 + 9x^2y^{10}$
30. $m^{18} + 24m^9y^4 + 144y^8$
31. $9x^4 - 54x^2y^6 + 81y^{12}$
32. $a^{2x} - 2a^xb^y + b^{2y}$
33. $9x^{8a-10} + 12x^{4a-5}y^{2a+1} + 4y^{4a+2}$
34. $m^{6a+12} - 8m^{3a+6}n^{3b} + 16n^{6b}$
35. $9a^{2x} + 3a^{4x}b^{4y} + \frac{1}{4}a^{6x}b^{8y}$
36. $\frac{16}{25}a^{4m-2} - \frac{12}{5}a^{2m-1}b + \frac{9}{4}b^2$
37. $0.36m^{4x} - 0.6m^{2x}n^4 + 0.25n^8$
38. $36x^{6m-4} + 60x^{3m-2}y^{4m}z^3 + 25y^{8m}z^6$
39. $0.09x^{4a} - 0.48x^{2a}y^{b-1} + 0.64y^{2b-2}$
40. $\frac{25}{9}x^{6a-4} + 4x^{3a-2}y^{1-3a} + \frac{36}{25}y^{2-6a}$
41. $\frac{x^{16-2y}}{4} + 3x^{8-y}y^{8-x} + 9y^{16-2x}$
42. $\frac{x^{8a}}{25} - \frac{b^{4x}x^{4a}y^{a+1}}{10} + \frac{b^{8x}y^{2a+2}}{16}$
43. $x^2 + 4y^2 + 9z^2 + 4xy + 6xz + 12yz$
44. $9x^2 + 4y^2 - 12xy + 6x - 4y + 1$
45. $a^2 + 36b^2 + 25c^2 + 12ab - 10ac - 60bc$
46. $a^4 + 10a^3 + 33a^2 + 40a + 16$
47. $a^4 + 6a^3 + 5a^2 - 12a + 4$
48. $x^4 - 4x^3 + 6x^2 - 4x + 1$
49. $x^2 + 2xy + y^2 - 4x - 4y + 4$
50. $4a^2 - 12ab + 9b^2 + 4a - 6b + 1$
51. $16m^2 + 25n^2 + p^2 + 40mn + 8mp + 10np$
52. $9x^4 + 4y^4 + 1 + 12x^2y^2 - 6x^2 - 4y^2$
53. $\frac{1}{4}a^2 + \frac{1}{9}b^2 + c^2 + ac + \frac{1}{3}ab + \frac{2}{3}bc$
54. $\frac{1}{36}x^2 + y^2 + \frac{1}{16} - \frac{1}{3}xy + \frac{1}{12}x - \frac{1}{2}y$
55. $\frac{4}{x^2} + \frac{9}{y^2} + \frac{1}{z^2} + \frac{12}{xy} - \frac{4}{xz} - \frac{6}{yz}$
56. $a^{2x} + b^{2y} + c^{2z} - 2a^xb^y + 2a^xc^z - 2b^yc^z$
57. $a^{2x+2} - 4a^{2x+1} + 2a^{2x} + 4a^{2x-1} + a^{2x-2}$

Ejercicio 35

1. $x^2 - 9$
2. $a^2 - 1$
3. $b^2 - 4$
4. $k^2 - 64$
5. $25 - y^2$
6. $81 - a^2$
7. $m^2 - n^2$
8. $x^2y^2 - z^2$
9. $9x^2 - 25y^2$
10. $16m^2 - 81n^2$
11. $4b^2 - 9c^2$
12. $36x^{10} - 1$
13. $9m^6 - 64$
14. $25x^8y^2 - 16z^2$
15. $81a^2b^8 - c^{14}$
16. $49a^8b^6 - c^2d^{10}$
17. $\frac{9}{25}m^2 - \frac{1}{4}$
18. $\frac{49}{36}x^6 - \frac{9}{4}$
19. $\frac{1}{9}x^2y^2 - z^{12}$
20. $9x^4 - \frac{1}{100}$
21. $9a^{2x-8} - b^{6x}$
22. $64y^{4a-6} - 16x^{8a}$
23. $a^2 + 2ab + b^2 - c^2$
24. $a^2 - b^2 + 2bc - c^2$
25. $m^2 - n^2 - 2np - p^2$
26. $x^2 + 2xy + y^2 - 9$
27. $16x^2 - 9y^2 + 6yz - z^2$
28. $x^4 + x^2y^2 + y^4$
29. $m^8 - m^4 - 2m^3 - m^2$
30. $4x^2 + 20xy + 25y^2 - 9z^2$
31. $x^2 + 4xy + 4y^2 - 1$
32. $\frac{1}{4}m^2 - \frac{1}{4}m + \frac{1}{16} - \frac{4}{9}n^2$
33. $\frac{4}{25}x^4 + \frac{37}{315}x^2y^2 + \frac{4}{49}y^4$
34. $\frac{1}{9}x^{2m+2} - \frac{1}{36}x^{2m} + \frac{1}{6}x^{2m-1} - \frac{1}{4}x^{2m-2}$

35. $a^2 + 2ab + b^2 - c^2 - 2cd - d^2$
36. $x^2 + 2xz + z^2 - y^2 + 2y - 1$
37. $m^2 - 10m + 25 - 4n^2 + 12np - 9p^2$
38. $x^2 - 2xy + y^2 - z^2 + 8z - 16$
39. $4x^2 + 12xy + 9y^2 - 16z^2 + 56z - 49$
40. $x^2 - 2xy + y^2 - 9z^2 - 30z - 25$

Ejercicio 36

1. $x^2 - 3x - 40$
2. $m^2 + 3m - 28$
3. $x^2 - 12x + 20$
4. $x^2 - 11x + 30$
5. $x^2 + 10x + 24$
6. $n^2 + n - 12$
7. $x^2 - 9x + 8$
8. $a^2 - 6a - 27$
9. $x^2 - 3x - 10$
10. $m^2 + 5m - 24$
11. $4x^2 - 4x - 24$
12. $9m^2 + 6m - 24$
13. $36x^2 - 6x - 12$
14. $16x^2 - 28x + 10$
15. $2 - 9x + 9x^2$
16. $25x^2 + 50x + 24$
17. $4 - 2x - 42x^2$
18. $25 - 35x - 18x^2$
19. $x^4 - 4x^2 - 60$
20. $m^6 - 12m^3 + 32$
21. $x^8 - 6x^4 - 72$
22. $x^{10} + x^5 - 2$
23. $a^6 - 7a^3 + 10$
24. $x^{4m-2} + 2x^{2m-1} - 35$
25. $a^4x^6 + 3a^2x^3b^4 + 2b^8$
26. $9x^{2m} - 9x^my^n - 28y^{2n}$
27. $x^2 - \frac{1}{2}x - \frac{1}{9}$
28. $\frac{1}{9}m^2 - \frac{1}{30}m - \frac{1}{5}$
29. $\frac{9}{16}y^2 - \frac{11}{32}y - \frac{5}{48}$
30. $x^2y^2 - \frac{11}{8}xy + \frac{15}{32}$
31. $\frac{9}{49}y^2 - \frac{9}{70}xy - \frac{2}{5}x^2$
32. $\frac{36}{25}x^4 + \frac{1}{10}x^2y^2 - \frac{1}{12}y^4$
33. $a^2 + 2ab + b^2 + 7a + 7b + 12$
34. $a^2 - 4ab + 4b^2 + 6a - 12b + 5$
35. $x^2 - 2xy + y^2 - 4xz + 4yz - 21z^2$
36. $4x^2 + 4xy + y^2 + 2x + y - 2$
37. $m^4 + 2m^2n^2 + n^4 + 4m^2 + 4n^2 - 45$
38. $a^2 - b^2 + 3c^2 - 4ac - 2bc$
39. $x^2 - 6y^2 - 4z^2 + xy - 3xz + 11yz$
40. $a^2 + c^2 - 25b^2 + 2ac$

Ejercicio 37

1. $x^3 - 3x^2 + 3x - 1$
2. $m^3 + 18m^2 + 108m + 216$
3. $x^3 - 6x^2 + 12x - 8$
4. $a^3 + 30a^2 + 300a + 1\,000$
5. $n^3 - 21n^2 + 147n - 343$
6. $x^3 + 9x^2 + 27x + 27$
7. $1 - 3x + 3x^2 - x^3$
8. $1\,000 - 300m + 30m^2 - m^3$
9. $8x^3 + 12x^2 + 6x + 1$
10. $27a^3 - 108a^2 + 144a - 64$
11. $8x^3 + 36x^2 + 54x + 27$
12. $1 - 12m + 48m^2 - 64m^3$
13. $27x^3 - 108x^2y + 144xy^2 - 64y^3$
14. $125m^6 + 150m^4n^5 + 60m^2n^{10} + 8n^{15}$
15. $27x^9y^3 - 54x^6y^2z^4 + 36x^3yz^8 - 8z^{12}$
16. $64x^6 + 96x^5y + 48x^4y^2 + 8x^3y^3$
17. $27m^{12} - 108m^{11}n + 144m^{10}n^2 - 64\,m^9n^3$
18. $x^3 + x^2 + \frac{1}{3}x + \frac{1}{27}$
19. $x^3 - \frac{3}{2}x^2 + \frac{3}{4}x - \frac{1}{8}$
20. $\frac{8}{27}x^3 - \frac{1}{3}x^2 + \frac{1}{8}x - \frac{1}{64}$
21. $\frac{27}{125}x^3 + \frac{36}{25}x^2y + \frac{16}{5}xy^2 + \frac{64}{27}y^3$
22. $\frac{1}{8}a^3 - \frac{9}{16}a^2b + \frac{27}{32}ab^2 - \frac{27}{64}b^3$
23. $\frac{1}{27}x^{12} + \frac{1}{3}x^8y + x^4y^2 + y^3$
24. $8x^{6a-9} - 36x^{4a-6}y^{4a+1} + 54x^{2a-3}y^{8a+2} - 27y^{12a+3}$

Ejercicio 38

1. $x^4 + x^2 - 2$
2. $m^4 - 65m^2 + 64$
3. $81x^4 - 162x^3 - 99x^2 + 180x + 100$
4. $625x^4 - 1\,800x^2 + 1\,296$
5. $m^6 - 12m^4 + 48m^2 - 64$
6. $x^4 - 72x^2 + 1\,296$
7. $n^8 - 36n^4 + 84n^2 - 49$
8. $x^{16} - 2x^8y^4 + y^8$
9. $16m^4 - 4m^3 - 200m^2 - 148m - 48$
10. $6\,561 - 1\,296x^{12}$
11. $x^4 - 41x^2 + 400$
12. $\frac{16}{81}x^{16} - \frac{8}{225}x^8y^{10} + \frac{1}{625}y^{20}$
13. $256x^8 - 32x^4y^4 + y^8$
14. $m^4 - m^2 - 2m - 1$
15. $x^4 - y^4$
16. $m^6 - 12m^4 + 48m^2 - 64$
17. $x^8 - 2x^4y^4 + y^8$
18. $x^4 - 10x^2 + 9$
19. $m^8 - 11m^4 - 80$
20. $n^{12} - 48n^8 + 768n^4 - 4\,096$

Capítulo 4

Ejercicio 39

1. $a(a + 1)$
2. $a^3b(b - 2)$
3. $a^2(a^2 + a - 1)$
4. $6x^4(3x + 5)$
5. $12x^2(4 - x - 2x^2)$
6. $5b^2(5 + 7b^2 - 9b^3)$
7. $11a(x - 11ax + 3a^2)$
8. $3ab(3a^4 - 4ab^2 + 5b - 6a^2b^3)$
9. $3(3x^2 + 2x + 1)$
10. $4x^2(x^2 - 2x + 3)$
11. $6x(x - y - 1)$
12. $14x^2(y^2 - 2x + 4x^2)$
13. $17a(2x^2 + 3ay - 4y^2)$
14. $55m^2(n^3x + 2n^3x^2 - 4y^3)$
15. $5x^2(5x^5 - 2x^3 + 3x - 1)$
16. $3a(3a - 4b + 5a^2b^2 - 8b^3)$
17. $12m^2n(1 + 2mn - 3m^2 + 4m^3n^3)$
18. $a^2b(3 + 6ab - 5a^2b^2 + 8a^3b^3 + 4a^4b^4)$
19. $8x^2y(2xy - x^2 - 3 - 5y^2)$
20. $50abc(2ab^2 - 3bc + b^2c^2 - 4c)$
21. $31a^2x(3axy - 2x^2y^2 - 4)$
22. $2x(3x - 1)^2(x + 3)$
23. $3(x + 1)(2 - x)$
24. $x(x + 2)(x - 1)$
25. $4x^2(2x - 5)(2x - 3)$
26. $(2x - 1)(3 - 2x)$

Ejercicio 40

1. $(m + n)(m + x)$
2. $(x^2 + 1)(3x - 1)$
3. $(x + y)(a - b)$
4. $(y - 3a)(2y^2 - 1)$
5. $(a - 2b)(m - 3n)$
6. $(a^2 - 3b)(4x - 5y)$
7. $(m^2 - 3n)(z^2 + p^2)$
8. $(5m + n^2)(mn + p^2)$
9. $(3a - 2b)(y^4 + 1)$
10. $(2m + 3n)(x^4 + 5)$
11. $(b - c)(y^2 + m^2)$
12. $(x + 3)(x^2 - 5)$
13. $(b - 3m)(3z - y)$
14. $(a^2 + 1)(a + 1)$
15. $(1 - 3a^2)(2a + 1)$
16. $(3x - 7)(x^2 + 1)$
17. $(1 - 4a)(b - 1)$
18. $(3m + 2)(6m^2 - 5)$
19. $(xz + my)(xy - mz)$
20. $(p^2t + m^2n)(pt^2 + mn^2)$

EJERCICIO 41

1. $(x-1)(x+1)$
2. $(x+7)(x-7)$
3. $(9-x)(x+9)$
4. $(4x-3)(4x+3)$
5. $(a^2+b^2)(a-b)(a+b)$
6. $(x^2+8)(x^2-8)$
7. $4(5-2x)(5+2x)$
8. $(6x-1)(6x+1)$
9. $(2-5x)(5x+2)$
10. $(2a^2-3bc)(2a^2+3bc)$
11. $(x^3+6)(x^3-6)$
12. $(4a^2b^3+c^3)(4a^2b^3-c^3)$
13. $\left(x-\frac{1}{2}\right)\left(x+\frac{1}{2}\right)$
14. $\left(x+\frac{2}{9}\right)\left(x-\frac{2}{9}\right)$
15. $\left(x-\frac{4}{7}\right)\left(x+\frac{4}{7}\right)$
16. $\left(x^2+\frac{1}{4}\right)\left(x-\frac{1}{2}\right)\left(x+\frac{1}{2}\right)$
17. $\left(7x-\frac{4}{5}\right)\left(7x+\frac{4}{5}\right)$
18. $\left(x^{3a}-y^{2b}\right)\left(x^{3a}+y^{2b}\right)$
19. $\left(a^{x+3}-3b^{3y}\right)\left(a^{x+3}+3b^{3y}\right)$
20. $\left(m^{2a+4}-5\right)\left(m^{2a+4}+5\right)$
21. $\left(1-x^{a}\right)\left(1+x^{a}\right)$
22. $\left(m^{3x-2y}-n^{4x+y}\right)\left(m^{3x-2y}+n^{4x+y}\right)$
23. $\left(4x^{3a}-7y^{b}\right)\left(4x^{3a}+7y^{b}\right)$
24. $(x+y-4)(x-y+2)$
25. $(2x+y+6)(2x-y-4)$
26. $(x-4y-1)(x+4y-1)$
27. $(3x-1)(9x-7)$
28. $(3x+2y)(5x+6y)$
29. $4(7x-9)(13x-6)$
30. $3x^2(3x-2)(5x+6)$

EJERCICIO 42

1. $(a+4)^2$
2. $(m-5)^2$
3. $(n-4)^2$
4. $(x-3)^2$
5. $(x+6)^2$
6. $(3a-5)^2$
7. $(11c-6)^2$
8. $(4a+3b)^2$
9. $(2a-5b)^2$
10. $(3a+b)^2$
11. $(2a-3b)^2$
12. $a^2(12x^2a-1)^2$
13. $(10a^2-3b)^2$
14. $(a^4+6bc)^2$
15. $(9a^6+11)^2$
16. $(7x^3-5ay^2)^2$
17. $(20a^5+1)^2$
18. $(x^4+9)^2$
19. $\left(\frac{y}{2}-z\right)^2$
20. $\left(\frac{p}{3}+1\right)^2$
21. $\left(x^2-\frac{y^2}{2}\right)^2$
22. $\left(\frac{5}{6}b^2-\frac{1}{5}\right)^2$
23. $\left(4m^3-\frac{n^2}{4}\right)^2$
24. $[3a+3x-2]^2$
25. $(2m-n+3)^2$
26. $(5a-b)^2$
27. $4n^2$
28. $(3a-b)^2$
29. $(b-m)^2$
30. $\left(\sqrt{x}+\sqrt{2y}\right)^2$
31. $\left(\sqrt{ax}+2\right)^2$
32. $\left(a^{\frac{3}{2}}-5\right)^2$
33. $\left(x^{\frac{1}{6}}+3\right)^2$
34. $\left(4x^{\frac{1}{4}}-1\right)^2$
35. $\left(m^{\frac{1}{3}}+2\right)^2$
36. $\left(\sqrt[3]{m}-3\right)^2$

EJERCICIO 43

1. $(x+2)(x+1)$
2. $(m-6)(m-5)$
3. $(n-4)(n-3)$
4. $(y-8)(y-7)$
5. $(x+6)(x+1)$
6. $(x+4)(x+3)$
7. $(a+6)(a+4)$
8. $(b-5)(b-2)$
9. $(m-5)(m-4)$
10. $(y+3)(y+1)$
11. $(x-4)(x-1)$
12. $(n+4)(n+2)$
13. $(a-18)(a+2)$
14. $(y+6)(y-5)$
15. $(x-9)(x+2)$
16. $(x-10y)(x-8y)$
17. $(a-10b)(a+5b)$
18. $(m-10n)(m+3n)$
19. $(x+8y)(x-7y)$
20. $(m^2+4)(m-1)(m+1)$
21. $(y-2)(y+2)(y^2-2)$
22. $(n+4)(n-4)(n-2)(n+2)$
23. $(a-6)(a+6)(a-1)(a+1)$
24. $(x^2-10)(x^2+9)$
25. $(ab+4)(ab-3)$
26. $(5y+7)(5y+6)$
27. $(y^3-7)(y^3+2)$
28. $(m-7n)(m+3n)$
29. $(5-b)(1+b)$
30. $(z^5+5)(z^5-4)$
31. $(y^2+12x)(y^2-5x)$
32. $(a-b+8)(a-b-3)$
33. $(x^2y^2-11)(x^2y^2+9)$
34. $(m^2n^2+12)\,(m^2n^2-11)$
35. $(n-18)(n-16)$
36. $(y+25)(y-22)$
37. $(c-44)(c+22)$
38. $(a+21)(a+12)$
39. $(x+33)(x+11)$
40. $(\mathrm{t}-54)(\mathrm{t}-45)$
41. $(x+8)(3-x)$
42. $(4-x)(x+3)$
43. $(x+8)(5-x)$
44. $(7-x)(x+6)$
45. $(8-3x)(3x+2)$
46. $(2x+9)(1-2x)$
47. $(7-8x)(8x+11)$
48. $(13-5x)(5x+11)$
49. $\left(x^{a}-9\right)\left(x^{a}-4\right)$
50. $\left(b^{2x}+9\right)\left(b^{2x}-8\right)$
51. $\left(y^{3a}+64\right)\left(y^{3a}+1\right)$
52. $\left(x^{4a}+2\right)\left(1-x^{a}\right)\left(1+x^{a}\right)\left(1+x^{2a}\right)$
53. $\left(9-x^{a+2}\right)\left(x^{a+2}+5\right)$
54. $(x-7)(x-3)$
55. $2(x-9)(2x+1)$
56. $(5x+y+7)(5x+y-6)$
57. $6a(6a-5)$
58. $(x+3y+11)(2-x-3y)$
59. $4(4x+7)(1-x)$
60. $(x+3y)(4y-x)$

EJERCICIO 44

1. $(5m-2)(m+3)$
2. $(3a+1)(a-2)$
3. $(3y+2)(2y+1)$
4. $(2x-1)(x+2)$
5. $(4n+3)(n+3)$
6. $(4x+1)(5x-1)$
7. $(7a+5)(a-7)$
8. $(y+2)(2y+1)$
9. $(4x+1)(5x+2)$
10. $(3m+2)(5m-6)$
11. $(2z+5)(10z-3)$
12. $(b+10)(2b+9)$
13. $(2y^2+3)(3y^2-2)$
14. $(2m^2-7)(7m^2+2)$
15. $(3ab-5)(2ab+5)$
16. $(3y+b)(5y-2b)$
17. $(n-3m)(6n+5m)$
18. $(3x+5)(6-x)$
19. $(4b^2+5)(3-2b^2)$
20. $(5x-3y)(6x+7y)$
21. $(2a^4+5)(5a^4+2)$
22. $(2a-15b)(3a+b)$
23. $(3x^2-2)(-2x^2-3)$
24. $(3x^5-10)(10x^5+3)$
25. $(2m-n)(3m-4n)$
26. $(2ax-7y)(3ax+5y)$
27. $(3a-2b)(8a+7b)$
28. $(xy+2)(4xy-5)$
29. $(a^2b-3c)(5a^2b+2c)$
30. $(m+10n)(2m-11n)$

EJERCICIO 45

1. $\left(x+\frac{1}{2}\right)\left(3x+\frac{1}{4}\right)$
2. $\left(x+\frac{2}{5}\right)\left(2x-\frac{1}{3}\right)$
3. $\left(3x+\frac{3}{2}\right)\left(2x+\frac{1}{4}\right)$
4. $\left(m+\frac{2}{3}\right)\left(5m+\frac{1}{2}\right)$
5. $\left(m+\frac{1}{3}\right)\left(4m-\frac{1}{5}\right)$
6. $\left(\frac{a}{6}+\frac{1}{9}\right)\left(a+\frac{3}{4}\right)$
7. $\left(x-\frac{1}{2}y\right)\left(\frac{2x}{3}+\frac{1}{4}y\right)$
8. $\frac{1}{25}\left(x-\frac{5}{3}\right)\left(3x+\frac{5}{4}\right)$
9. $\frac{1}{24}(x-3y)\left(x-\frac{4}{3}y\right)$
10. $\left(\sqrt{x}+5\right)\left(2\sqrt{x}+3\right)$
11. $\left(3\sqrt{x}-2\right)\left(4\sqrt{x}+1\right)$
12. $\left(5\sqrt{x}+4\right)\left(3\sqrt{x}-7\right)$
13. $\left(x^{\frac{1}{2}}-3y^{\frac{1}{2}}\right)\left(2x^{\frac{1}{2}}+y^{\frac{1}{2}}\right)$
14. $\left(2x^{\frac{1}{3}}+5\right)\left(3x^{\frac{1}{3}}-8\right)$
15. $\left(x^{\frac{1}{3}}+2\right)\left(3x^{\frac{1}{3}}-1\right)$
16. $\left(\sqrt{x+y}-2\right)\left(5\sqrt{x+y}+4\right)$
17. $\left(3x^{\frac{2}{3}}-8y^{\frac{1}{2}}\right)\left(4x^{\frac{2}{3}}+5y^{\frac{1}{2}}\right)$
18. $\left(2x^{\frac{2}{3}}+3y^{\frac{2}{3}}\right)\left(4x^{\frac{2}{3}}-5y^{\frac{2}{3}}\right)$

EJERCICIO 46

1. $(2x-1)(4x^2+2x+1)$
2. $(x+3)(x^2-3x+9)$
3. $(2x+y)(4x^2-2xy+y^2)$
4. $(3a-b)(9a^2+3ab+b^2)$
5. $(2a+3b^2)(4a^2-6ab^2+9b^4)$
6. $(4a-9)(16a^2+36a+81)$
7. $(8-3a^3)(64+24a^3+9a^6)$
8. $(x^2-2y^4)(x^4+2x^2y^4+4y^8)$
9. $(1-6m)(1+6m+36m^2)$
10. $(a-5)(a^2+5a+25)$
11. $(3m+4n^3)(9m^2-12mn^3+16n^6)$
12. $(7x-8y^2)(49x^2+56xy^2+64y^4)$
13. $(a^2+5b^4)(a^4-5a^2b^4+25b^8)$
14. $(2x^2+9)(4x^4-18x^2+81)$
15. $(3m^2+7n^3)(9m^4-21m^2n^3+49n^6)$
16. $\left(x^{\frac{1}{9}}+y^{\frac{1}{9}}\right)\left(x^{\frac{2}{9}}-x^{\frac{1}{9}}y^{\frac{1}{9}}+y^{\frac{2}{9}}\right)$
17. $\left(a^{\frac{1}{4}}-2b^{\frac{1}{4}}\right)\left(a^{\frac{1}{2}}+2a^{\frac{1}{4}}b^{\frac{1}{4}}+4b^{\frac{1}{2}}\right)$
18. $\left(x^{\frac{1}{2}}+5y^{\frac{3}{2}}\right)\left(x-5x^{\frac{1}{2}}y^{\frac{3}{2}}+25y^3\right)$
19. $(x^{a+1}-y^{2a})(x^{2a+2}+x^{a+1}y^{2a}+y^{4a})$
20. $(3y-x)(7x^2+3xy+3y^2)$
21. $(x+y)(x^2-4xy+7y^2)$
22. $(-2n)(27m^2+18mn+4n^2)$
23. $-(a+2b)(7a^2+19ab+13b^2)$
24. $\frac{1}{216}(5x-y)(7x^2+5xy+19y^2)$

EJERCICIO 47

1. $(x+4y)(x^2-4xy+16y^2)$
2. $(a-2)(a^6+2a^5+4a^4+8a^3+16a^2+32a+64)$
3. $(3-2x)(81+54x+36x^2+24x^3+16x^4)$
4. $(x+1)(x^6-x^5+x^4-x^3+x^2-x+1)$
5. $(m-n)(m^4+m^3n+m^2n^2+mn^3+n^4)$
6. $(x-ab)(x^6+x^5ab+x^4a^2b^2+x^3a^3b^3+x^2a^4b^4+xa^5b^5+a^6b^6)$
7. $(1-a)(1+a+a^2+a^3+a^4)$
8. $(xy+5)(x^4y^4-5x^3y^3+25x^2y^2-125xy+625)$
9. $(x-1)(x^8+x^7+x^6+x^5+x^4+x^3+x^2+x+1)$
10. $(x+2)(x^8-2x^7+4x^6-8x^5+16x^4-32x^3+64x^2-128x+256)$

EJERCICIO 48

1. $(m+2n+1)(m-2n+1)$
2. $(y+z-3)(y-z-3)$
3. $(x-y+5)(x+y-5)$
4. $(m^2-n^3-3)(m^2+n^3+3)$
5. $(7m^2-5m+3n)(7m^2+5m-3n)$
6. $(m+a-x-3)(m+a+x+3)$
7. $(1-a-3n)(1+a+3n)$
8. $(m-n+1)(m+n+3)$
9. $(1-y+b)(1+y-b)$
10. $(5p+m+1)(5p-m-1)$
11. $(m-n+2)(m+n+10)$
12. $(x+y+4a+3b^5)(x+y-4a-3b^5)$
13. $(10-3y+m-ap)(10-3y-m+ap)$
14. $(a+5b+m+3n)(a+5b-m-3n)$
15. $(2m-7n-3a-5b)(2m-7n+3a+5b)$

EJERCICIO 49

1. $(x-2)(x-1)$
2. $(x-5)(x+4)$
3. $(m-5)(m-2)$
4. $(x-8)(x+6)$
5. $(a-10)(a+4)$
6. $(n+9)(n-6)$
7. $(3x+4)(x+2)$
8. $(3m+2)(2m+1)$

9. $(3a-4)(a+1)$
10. $(3x+4)(2x-3)$
11. $(n^2+n+1)(n^2-n+1)$
12. $(a^2-2a-1)(a^2+2a-1)$
13. $(m^4-2m^2n^2+4n^4)(m^4+2m^2n^2+4n^4)$
14. $(x^2+5x-10)(x^2-5x-10)$
15. $(8a^2-6a+7)(8a^2+6a+7)$
16. $(a^2b^2-ab+11)(a^2b^2+ab+11)$
17. $(6m^2-5mn-7n^2)(6m^2+5mn-7n^2)$
18. $(x^2+xy+y^2)(x^2-xy+y^2)$
19. $(a^2-ab-3b^2)(a^2+ab-3b^2)$
20. $(2m^4+5m^2n^2-7n^4)(2m^4-5m^2n^2-7n^4)$

EJERCICIO 50

1. $x(x-7)(x+4)$
2. $3(a-2)(a+1)$
3. $3m(m-1)(m+1)$
4. $(y^2+1)(y-2)(y+2)$
5. $(m-1)^2(m+1)$
6. $a(2x+1)(3x-2)$
7. $x(x^2+1)(x-1)$
8. $2a(2x+1)(2x-1)$
9. $a(a^2+2)(a-1)(a+1)$
10. $(2+m)(2-m)(4-2m+m^2)(4+2m+m^2)$
11. $(x-4)(x-3)(x+4)(x+3)$
12. $(a-b)(a^2-ab+b^2)(a+b)^2$
13. $a(a^4+b^4)(a^2+b^2)(a+b)(a-b)$
14. $a(x+1)^3$
15. $(a^3+2)(a^2+3a+9)(a-3)$
16. $(a+1)(a-1)(a^2-a+1)$
17. $4m^2(y-1)(y^2+y+1)$
18. $3mn(p-2)(p+3)$
19. $(4+a)(4-a)(16+a^2)$
20. $(a-b)(a^4+b^4)(a^2+b^2)(a+b)$
21. $2(2x+1)(2x-1)(x^2+1)$
22. $5m(xy+2)(y-1)(y+1)$
23. $(a+3)(a-3)(a^2+3a+9)(a^2-3a+9)$
24. $x(x-y)(x+y)(x^2+xy+y^2)(x^2-xy+y^2)$
25. $(a-1)^2(a-b)(a+b)$
26. $4a(a^2-a+1)(a^2+a+1)$
27. $(m-1)(m+2)(m-2)$
28. $y(y+2)(y+6)(y-2)(y-6)$
29. $m(m^2+1)(m-1)(m+1)$
30. $-m(3m-y)^2$

EJERCICIO 51

1. $(b-1)^2(b+1)$
2. $(w-1)(w+1)(w+2)$
3. $(x-3)(x-2)(x+1)$
4. $(x-4)(x+2)(x+3)$
5. $(x-1)(2x-1)(2x+3)$
6. $(m+2)(m^2+1)$
7. $(y+1)(3y+2)(2y-3)$
8. $(a-3)(a-1)(a+1)(a+3)$
9. $(x-4)(x+5)(3x+1)$
10. $(m+5)(m+4)(m^2-3m+7)$
11. $(n-2)^2(n+1)^2$
12. $(x-2)^2(x+1)(x-1)$
13. $(x-1)^2(x+2)(x-3)$
14. $(x-3)(x-2)(x-1)(x+1)^2$
15. $(a-6)(a+2)(a+5)(a^2-a+3)$
16. $(x-3)(x-2)(x+1)(x+2)(2x-1)$
17. $(x-3)(x-2)(x-1)(x^2+2x+4)$
18. $(x-2)(x-1)(x+3)(2x-1)(3x+5)$
19. $(n-3)(n+3)(n-2)(n+2)(n-1)(n+1)$
20. $(x-5)(x-1)(x+1)(2x+7)(x^2+1)$

CAPÍTULO 5

EJERCICIO 52

	MCD	mcm
1.	$7x^2y^3z^2$	$210x^2y^5z^4$
2.	$24m^2y^2$	$1\,440m^4y^5$
3.	$2xy$	$40x^3y^3z^2$
4.	$13abc$	$156\,a^2b^2c^2$
5.	$15mn^x$	$2\,100m^4n^{x+2}$
6.	$11x^a\,y^b$	$132x^{a+2}\,y^{b+2}$
7.	$6a^2(x-1)^2$	$360\,a^5(x-1)^4$
8.	$9(a-b)(x+y)$	$135(a-b)^2(x+y)^2$
9.	6	$360(2x+1)^2(x-7)(x+8)^2$
10.	$19a(1+b)$	$228\,a^4(1+b)^3$
11.	$x+1$	$xy(x+1)$
12.	$m-1$	$(m-1)(m+1)(m^2+m+1)$
13.	$m+n$	$m^2n(m+n)$
14.	$x-y$	$(x-y)^2(x+y)$
15.	$x-2$	$3xy(x-2)(x+2)(x+1)$
16.	$3a-1$	$a(3a-1)^2(9a^2+3a+1)$
17.	$m-4$	$m(m-4)(m+3)(m+2)(m-5)$
18.	$a(a-1)$	$12a^2(a-1)$
19.	$2b+1$	$(2b+1)(6b+1)(b-3)$
20.	$y-3$	$(y-3)(y+2)(y-1)(2y+1)(2y+3)$

EJERCICIO 53

1. $\frac{2a+2b}{3ab}$
2. $\frac{2a^2b}{a-2b}$
3. $\frac{a+3}{2a}$
4. $\frac{2m^2-6m-8}{5-3m}$
5. $-\frac{m^2n}{n+m}$
6. $\frac{2}{x+2}$
7. $-\frac{x+2y}{x+y}$
8. $\frac{x+13}{x+6}$
9. $\frac{n-2}{n+1}$
10. $\frac{2x+3y}{3x+y}$
11. $\frac{x(2y-x)}{5x+y}$
12. $\frac{3x+4y}{x-3y}$
13. $\frac{b(m-n)}{m+n}$
14. $-\frac{x^2+2x+4}{x+4}$
15. $\frac{x^2-xy+y^2}{x-y}$
16. $\frac{y^2+3xy+9x^2}{y+2x}$
17. $\frac{x-1}{x-2}$
18. $\frac{x-y}{x+2y}$
19. $\frac{1}{x+y}$
20. $\frac{a-d}{2ab}$
21. $\frac{y-2}{3a+2}$
22. $\frac{3x}{w-z}$
23. $\frac{w+2}{y-x}$
24. $\frac{p+1}{2-p}$
25. -1
26. $\frac{x+1}{x+3}$
27. $\frac{x-1}{x-4}$
28. $\frac{y-2}{y+2}$
29. $\frac{4-y}{y(y+1)}$
30. $\frac{(2-a)(a+4)}{a-3}$

EJERCICIO 54

1. $\frac{4x-3}{4x}$ 2. $\frac{a^2-6}{a}$ 3. $\frac{3n-1}{2n}$ 4. $\frac{19m-9}{4n}$ 5. $\frac{4}{n}$ 6. $\frac{3y-5}{2y}$ 7. $\frac{x^2+1}{2x}$ 8. 5 9. 1

EJERCICIO 55

1. $\frac{7}{20}$
2. $\frac{7x+9}{6x}$
3. $\frac{3x^2-7x-8}{18x^2}$
4. $\frac{4x^2+7x-18}{12x^2}$
5. $-\frac{h}{(x+h+2)(x+2)}$
6. $-\frac{2h}{(x+h-1)(x-1)}$
7. $-\frac{4xh+2h^2}{\left((x+h)^2-3\right)(x^2-3)}$
8. $\frac{2xh+h^2}{\left((x+h)^2+1\right)(x^2+1)}$
9. $\frac{x}{x-3}$
10. $\frac{3x}{x^2-1}$
11. $\frac{x}{x-2}$
12. $\frac{5x+1}{(x^2-1)(x-1)}$
13. $\frac{7x^2-20x+3}{(x^2-9)(x+3)}$
14. $\frac{5x^2-12x}{3(x-2)^{\frac{2}{3}}}$
15. $\frac{9x^5+12x^3}{(x^2+1)^{\frac{1}{2}}}$
16. $-\frac{14x}{(3x^2+2)^{\frac{1}{2}}(x^2-4)^{\frac{1}{2}}}$
17. $\frac{2x^3-24x}{3(5-x^2)^{\frac{2}{3}}(x^2+2)^{\frac{1}{3}}}$
18. $\frac{8x^2}{(16x^4-9x^2)^{\frac{2}{3}}}$
19. $\frac{x^2-3x-40}{(x+4)(x+8)(x-3)}$
20. $\frac{2x^3+2x^2-5x+34}{(x+3)(x-2)(x+4)}$
21. $\frac{4}{x+4}$
22. $\frac{4}{2x+5}$
23. $\frac{3m}{m^2-mn+n^2}$
24. $\frac{2x^2+27xy-5y^2}{(x+5y)(x-2y)(x-y)}$
25. $\frac{5a}{18(a+b)}$
26. $\frac{rs}{r^2-s^2}$

EJERCICIO 56

1. $\frac{8}{7ab^2x^2}$
2. $\frac{3}{y}$
3. $\frac{y^2}{8bx}$
4. $\frac{16ax}{3b^2}$
5. $\frac{b}{4xy}$
6. $\frac{m+1}{4}$
7. $\frac{b(b-3)}{b-6}$
8. 1
9. $\frac{x}{6}$
10. $\frac{7}{2}$
11. $\frac{5}{2x}$
12. $\frac{x+3}{x-5}$
13. $-\frac{x+6}{x+5}$
14. $\frac{4x+3}{3x+4}$
15. $\frac{x^2+3x+2}{x^2-9x+18}$
16. $\frac{x+6}{4x+1}$
17. $\frac{x(x+3)}{2x+1}$
18. $\frac{x-3}{a-1}$
19. $2\left(\frac{x-5}{x-3}\right)$
20. $\frac{n+4}{n-4}$

EJERCICIO 57

1. $\frac{3y}{4x^2}$
2. $\frac{a^2b^4}{x^4}$
3. $\frac{3}{x^2(2x+3)^2}$
4. $6x^3(2x^3+1)^{\frac{1}{3}}$
5. $\frac{4(x+y)}{3}$
6. $\frac{x^2+1}{x^2}$
7. $\frac{x-9}{x+9}$
8. $\frac{x+1}{x-1}$
9. $\frac{x^2-6x+5}{x^2+x-12}$
10. $\frac{x^2-11x+30}{3x^2-14x+8}$
11. $\frac{2x-1}{2x-5}$
12. $\frac{x+4}{x}$
13. $\frac{1}{2x-1}$
14. $\frac{x+11}{x^2-7x}$
15. $\frac{x^2-2x-35}{x^2-8x}$
16. $\frac{1}{a+3}$
17. $\frac{5x+1}{2x^2+3x}$
18. $\frac{b}{a+b}$
19. $\frac{x^2+6x+8}{x^2+6x+9}$
20. $\frac{n}{n^2+2}$
21. $\frac{a^2+ab}{a-b}$
22. $\frac{x^2-1}{x^3+2}$

EJERCICIO 58

1. $\frac{1}{x-7}$
2. $\frac{a+1}{a^2+a+1}$
3. $\frac{a+1}{a-1}$
4. $\frac{t+1}{t}$
5. $\frac{2(x-4)}{3(x+3)}$
6. $\frac{x}{6x^2-7x+2}$
7. $\frac{6x^2+9}{2x^2-x-3}$
8. $\frac{x-3}{x-10}$
9. $\frac{(2x-3)^2}{x(2x+3)}$
10. $\frac{(x-5)^2(x+3)^2}{(x-2)^2(x-1)^2}$
11. $\frac{3x^2+5x}{(x+1)(x+3)}$
12. $\frac{2x^2-x-25}{x^2-25}$

EJERCICIO 59

1. $\frac{x}{x+1}$
2. $\frac{n-1}{2n-1}$
3. $\frac{y}{2y-3}$
4. $\frac{m+3}{m-5}$

5. y^2+y+1
6. $\frac{b+a}{b-a}$
7. x
8. $\frac{n-3}{n^2+4n}$
9. $\frac{a-4b}{a-3b}$
10. $\frac{1}{y(y-x)}$
11. $ab-b^2$
12. $a-2b$
13. $\frac{x+2}{2(x+1)^{\frac{1}{2}}(2x+3)^{\frac{3}{2}}}$
14. $\frac{x^3-10x}{(x^2-5)^{\frac{3}{2}}}$
15. $\frac{-2}{(3x-1)^{\frac{2}{3}}(3x-1)^{\frac{4}{3}}}$
16. $\frac{1-5x^2}{3x^{\frac{2}{3}}(5x^2+1)^{\frac{4}{3}}}$

Capítulo 6

Ejercicio 60

1. $x=3$
2. $y=10$
3. $z=-1$
4. $x=-2$
5. $x=4$
6. $y=3$
7. $x=\frac{8}{3}$
8. $x=-\frac{4}{5}$
9. w = – 2
10. $z=-\frac{11}{7}$
11. $x=5$
12. $x=2$
13. $y=-3$
14. $z=-8$
15. $w=-14$
16. $x=-\frac{1}{2}$
17. $x=\frac{1}{2}$
18. $y=-2$
19. $x=6$
20. $x=\frac{11}{10}$
21. $y=-3$
22. $x=14$
23. $x=\frac{11}{23}$
24. $z=3$
25. $y=-\frac{9}{13}$
26. $x=\frac{1}{3}$
27. $z=\frac{23}{17}$
28. $y=\frac{17}{21}$
29. $x=-\frac{13}{21}$
30. $z=\frac{1}{19}$
31. $x=-4$
32. $x=3$
33. $x=-2$
34. $x=-\frac{2}{3}$
35. $w=-1$
36. $z=\frac{7}{20}$
37. No tiene solución
38. Todos los reales
39. Todos los reales
40. No tiene solución

Ejercicio 61

1. $x=3$
2. $x=\frac{21}{11}$
3. $x=-\frac{9}{2}$
4. $x=\frac{23}{8}$
5. $x=\frac{41}{32}$
6. $w=-\frac{3}{7}$
7. $y=-5$
8. $y=2$
9. $y=1$
10. $w=19$
11. $x=\frac{1}{5}$
12. $x=\frac{1}{2}$
13. $x=-\frac{7}{3}$
14. $x=-\frac{1}{9}$
15. $x=\frac{4}{3}$
16. $x=-1$
17. $x=\frac{20}{7}$
18. $x=0$
19. $x=\frac{2}{3}$
20. $x=-\frac{155}{8}$

Ejercicio 62

1. $x=18$
2. $x=\frac{4}{5}$
3. $x=-\frac{9}{4}$
4. $x=-6$
5. $x=-\frac{9}{2}$
6. $x=\frac{5}{8}$
7. $x=-\frac{8}{5}$
8. $x=6$
9. $x=8$
10. $x=\frac{10}{3}$
11. $x=-8$
12. $x=\frac{27}{11}$
13. $x=\frac{25}{13}$
14. $x=\frac{1}{3}$
15. $z=\frac{6}{5}$
16. $x=\frac{46}{51}$
17. $z=-\frac{1}{23}$
18. $x=\frac{3}{7}$
19. $x=-\frac{5}{4}$
20. $x=-\frac{7}{11}$
21. $x=\frac{9}{11}$
22. $x=-\frac{14}{31}$
23. $x=-\frac{7}{12}$
24. $y=2$
25. $x=1$
26. $x=35$
27. $x=\frac{8}{5}$
28. $z=-\frac{28}{3}$
29. $x=\frac{1}{9}$
30. $x=-\frac{1}{2}$
31. $z=\frac{28}{3}$
32. $y=6$

Ejercicio 63

1. $x=7, x=-9$
2. $y=-1, y=4$
3. $m=\frac{4}{3}, m=-4$
4. $x=3, x=-\frac{13}{5}$
5. $y=0, y=4$
6. $m=-3, m=-2$
7. $x=\frac{3}{2}, x=-\frac{5}{2}$
8. $m=1$
9. $x=-\frac{4}{7}, x=0$
10. $x=7, x=1$
11. $x=-\frac{5}{3}, x=-\frac{7}{3}$
12. $x=18, x=-2$
13. $x=-\frac{1}{5}, x=\frac{9}{7}$
14. $x=-4, x=5$
15. $x=-\frac{4}{5}, x=\frac{4}{11}$
16. $x=\frac{3}{2}$
17. $x=4, x=\frac{2}{3}$
18. $x=\frac{1}{4}, x=\frac{1}{2}$
19. $x=\frac{2}{5}, x=2$
20. $x=\frac{59}{8}, x=\frac{53}{8}$
21. $x=-9, x=3$

Ejercicio 64

1. $x=a$
2. $y=\frac{a+1}{2}$
3. $x=b-a$
4. $y=\frac{b+1}{a+1}$
5. $x=\frac{mn}{n+m}$
6. $x=m+n$
7. $x=b-a$
8. $y=m$
9. $z=2m$
10. $z=0$

EJERCICIO 65

1. 103,104,105
2. 234 y 217
3. 90,92, 94
4. 13, 15 17
5. 68 y 32
6. 28 y 70
7. 18 y 12
8. 12 y 8
9. 80
10. 12
11. 7 y 3
12. 6 y 5
13. 8
14. 24 y 12
15. 30 y 10
16. 20, 15 y 10
17. 55 y 5
18. 15 y 8
19. 14 y 6
20. 32 y 24
21. 35
22. 64
23. 15
24. 45
25. 72
26. 38
27. 54
28. 24
29. 97
30. 96
31. 124
32. 264
33. 436

EJERCICIO 66

1. Andrés: 35 años, Carlos: 31 años, Rodolfo: 24 años
2. 24 años
3. Luz: 11 años, María: 14 años, Tania: 17 años
4. Dentro de 6 años
5. Carlos: 30 años, Mauricio: 10 años
6. Bárbara: 8 años, Patricia 16 años
7. 7 años
8. Omar: 16 años, Alejandra: 36 años
9. 8 años
10. 20 años
11. Guillermo: 48 años, Patricia: 36 años
12. Joaquín: 10 años, Julián: 20 años, Camilo: 30 años
13. Antonio: 25 años, Ivan: 15 años
14. 18 años
15. Juan Carlos: 15 años, Daniel 20 años

EJERCICIO 67

1. 48 litros
2. 40 litros
3. 40 gramos
4. 180 litros
5. 10 litros
6. 0.6 litros
7. 6 onzas
8. 10 litros
9. 25 ml al 4%, 50 ml al 1%
10. 50 ml al 5%, 50 ml al 2%
11. 10 litros al 30%, 20 litros al 3%
12. 60 onzas al 30%, 90 onzas al 80%
13. 1 000 litros al 56%, 1 400 litros al 80%
14. 92% y 62%

EJERCICIO 68

1. 180 monedas
2. 7 de $500, 5 de $1 000, 4 de $200
3. 20 de $5, 10 de $10
4. 100 de 50¢, 300 de $1
5. 6 monedas
6. 8 de $200, 7 de $100, 6 de $50
7. 12 de $10, 36 de $5, 46 de $2
8. 30 monedas
9. 6 de $5, 12 de $2
10. 60 monedas
11. 8 billetes

EJERCICIO 69

1. $600
2. chamarra: $800
   pantalón: $400
   blusa: $120
3. $3 600
4. 185 000, 80 000, 167 000
5. $200
6. escritorio: $2 500
   computadora: $12 600
7. 10 problemas correctos
8. $5 200
9. $360
10. 20 horas extras
11. 20 kg de $9.30
    10 kg de $12
12. 4 de adulto y 2 de niño
13. 8 000 de $60 y 4 000 de $80
14. 4 kg de $100
    8 kg de $70
    8 kg de $105

EJERCICIO 70

1. 1 hora 12 minutos
2. 2 horas 24 minutos
3. 16 horas
4. 2 horas 40 minutos
5. $1\frac{11}{13}$ horas
6. 3 horas
7. 4 horas
8. $25\frac{5}{7}$ minutos
9. $7\frac{11}{12}$ horas
10. 16 horas 30 minutos

Ejercicio 71

1. 36 segundos
2. 25 segundos
3. 10 minutos
4. 12:18 pm
5. 108 metros
6. 16 segundos
7. 1.5 km
8. 14:34 pm
9. 8:37 am
10. 20:36 pm

Ejercicio 72

1. 62°
2. 45°
3. ancho: 12 cm, largo: 36 cm
4. ancho: 24 metros, largo: 58 metros
5. ancho: 4 metros, largo: 36 metros
6. 6, 7 y 10 metros
7. 8 cm
8. 10 y 4 cm
9. radio: $\frac{15}{\pi}$, largo: 11.25 cm
10. 6 metros
11. ancho: 9 metros, largo: 18 metros
12. ancho: 6 metros, largo: 23 metros
13. radio: 15 metros
14. ancho: 3 unidades, largo: 8 unidades
15. base: 6 unidades, altura: 4 unidades
16. $h = \frac{64 - 3\pi}{8}$
17. 12 unidades
18. ancho: 60 cm, largo: 160 cm

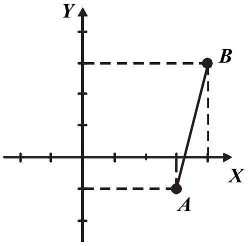
Ejercicio 73

1. $n = \frac{P\ v}{r\ t}$
2. $\ell = \frac{P - 2\omega}{2}$
3. $m = \frac{y - b}{x}$
4. $r = \frac{a \square s}{\ell \square s}$
5. $F = \frac{9}{5}C + 32$
6. $r = \sqrt{\frac{A}{\pi}}$
7. $b = \frac{2A}{h} - B$
8. $x_2 = \frac{y_2 - y_1 + mx_1}{m}$
9. $h = x \pm \sqrt{r^2 - (y - k)^2}$
10. $F = \frac{B^2 + C^2 - 4A^2r^2}{4A}$
11. $d = \frac{u - a}{n\ - 1}$
12. $r = \sqrt[n-1]{\frac{u}{a}}$
13. $P_0 = \frac{P}{e^{kt}}$
14. $V_0 = \sqrt{V_f{}^2 - 2ad}$
15. $m = \frac{Fr^2}{\mathrm{GM}}$
16. $i = \sqrt[t]{\frac{M}{C}} - 1$
17. $m_1 = \frac{m_2 - tg\alpha}{1 + \mathrm{m_2 tg}\alpha}$
18. $x = \frac{-b \pm \sqrt{b^2 + 4a(y - c)}}{2a}$
19. $p' = \frac{pf}{f\ -\ p}$
20. $t = \frac{-v \pm \sqrt{2da + v^2}}{a}$

Capítulo 7

Ejercicio 74

1.



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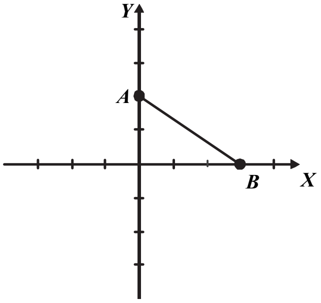

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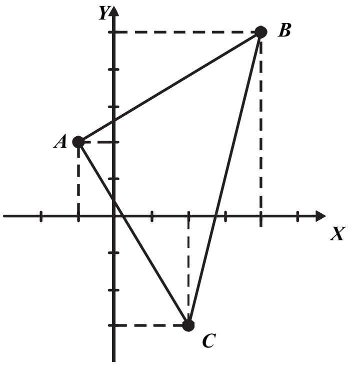

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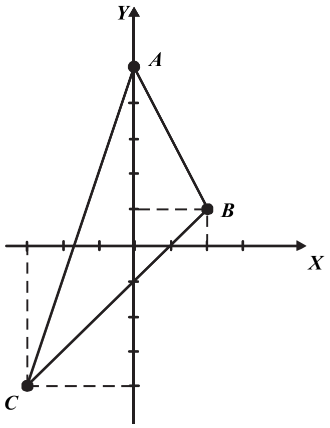

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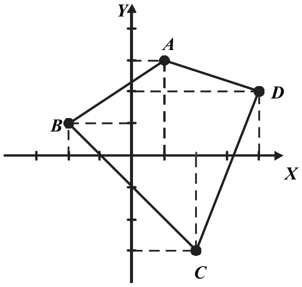
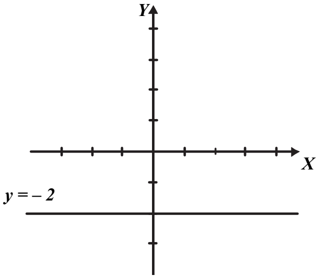


Ejercicio 75

1. $m = 1$
2. $m = -12$
3. $m = \frac{8}{9}$
4. $m = -\frac{22}{27}$
5. $m = \frac{5}{14}$

Ejercicio 76

1.



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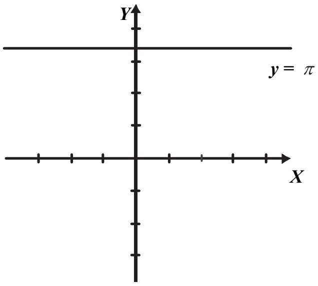

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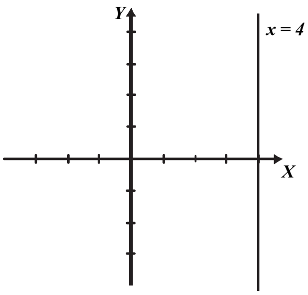

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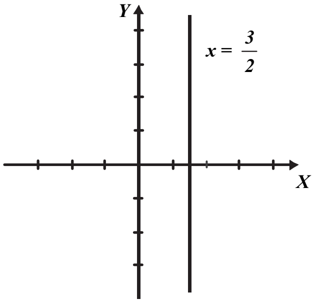

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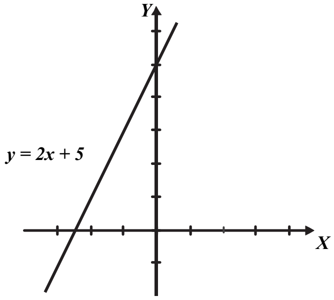

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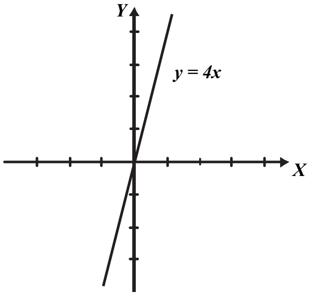

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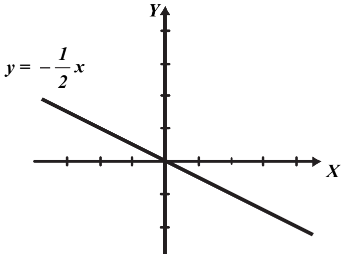

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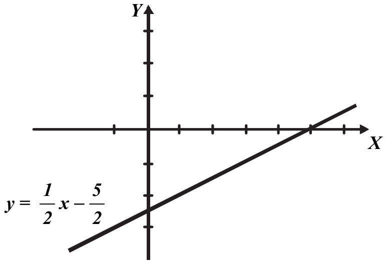

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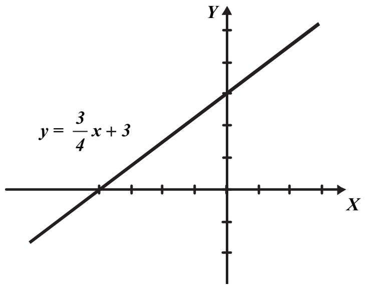

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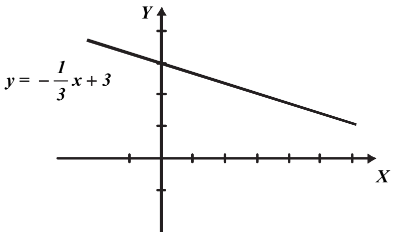
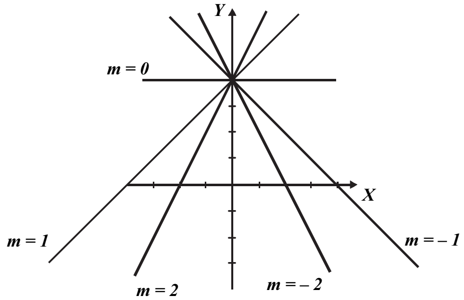


Ejercicio 77

1.



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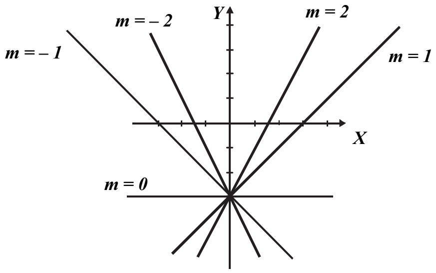

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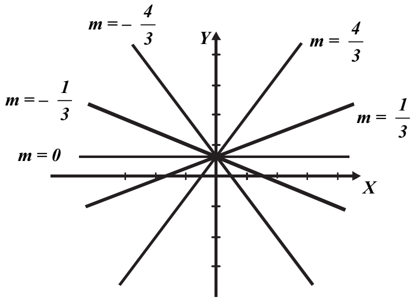

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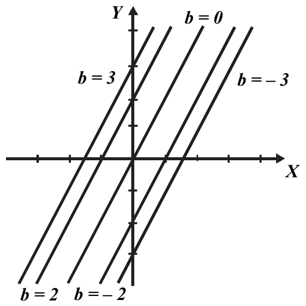

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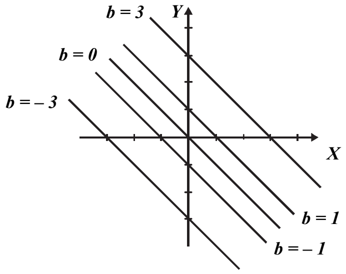

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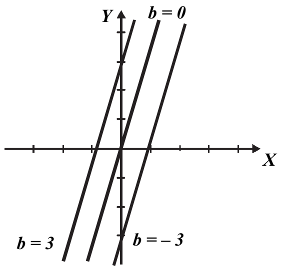


Ejercicio 78

1. $S = 40t$

2. a) $P = \frac{7}{3}t + 3.5$
   b) $P = 24.5$ kg
   c) $t = 10$ años 6 meses

3. $C = \frac{19}{30}T + \frac{1681}{3}$

4. a) $G = \frac{11}{20}I + 1800$
   b) $U = \frac{9}{20}I - 1800$
   c) $R = \$4000$

5. a) C = F = – 40º
   b) C = 160º y F = 320º

Capítulo 8

Ejercicio 79

1. $(2,-3),(7,0)$ son solución

2. $\left(\frac{1}{2},-\frac{3}{4}\right)$ es solución

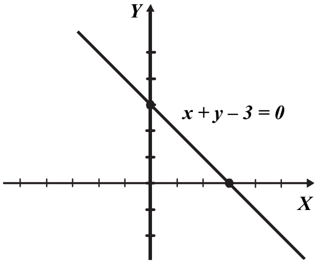
3. $(3,-4)$, $(-3,-12)$ son solución

4. $\left(\frac{1}{5},\frac{2}{3}\right)$ es solución

5. $\left(-\frac{1}{2},\frac{3}{10}\right)$ es solución

EJERCICIO 80

1.



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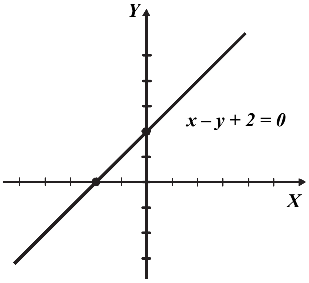

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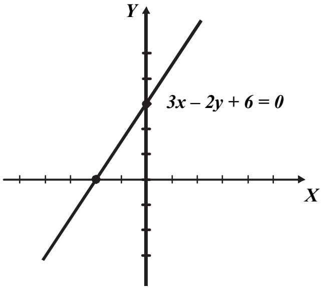

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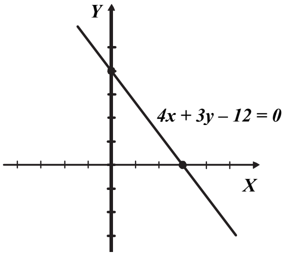

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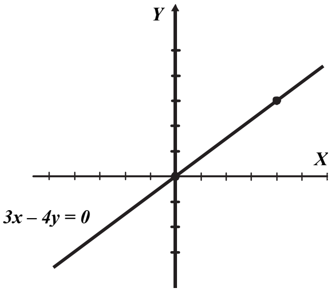

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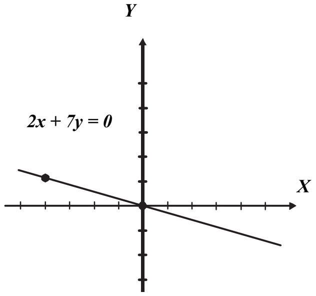

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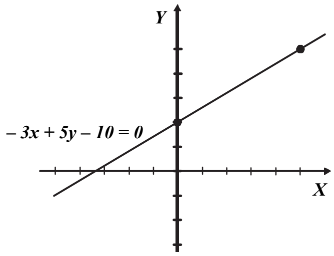

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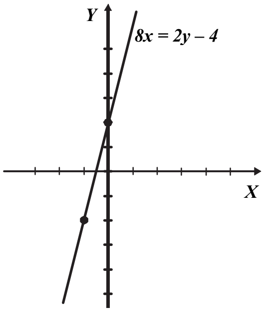

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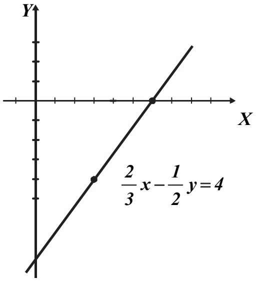

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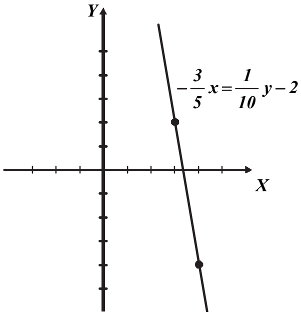
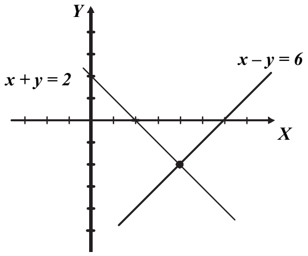
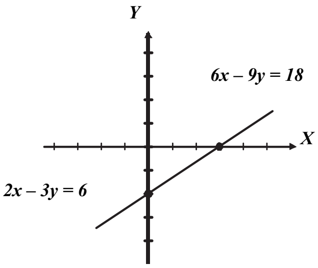


EJERCICIO 81

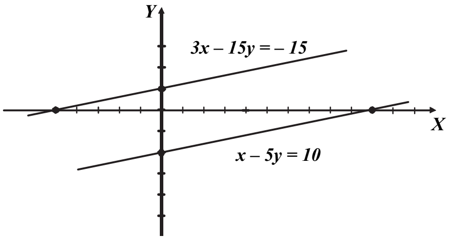
1. $(4,-2)$



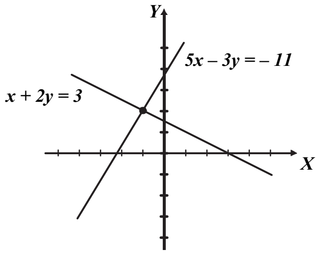
2. Conjunto infinito de soluciones (rectas coincidentes)



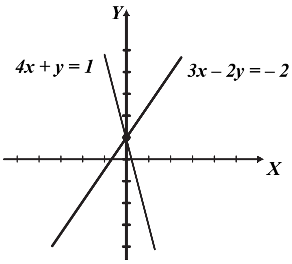
3. Conjunto vacío (rectas paralelas)



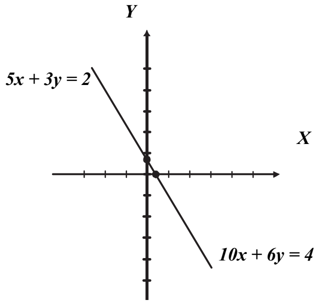
4. $(-1,2)$



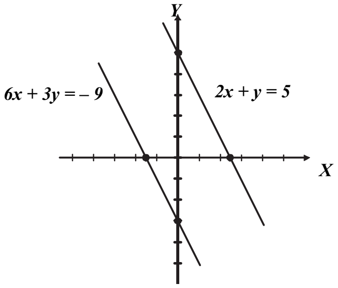
5. $(0,1)$



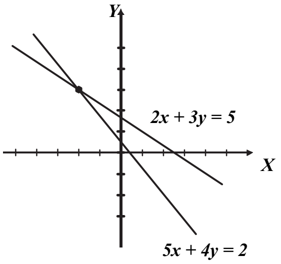
6. Conjunto infinito de soluciones (rectas coincidentes)



7. Conjunto vacío (rectas paralelas)



8. $(-2,3)$



EJERCICIO 82

1. $\begin{cases} x=3 \\ y=1 \end{cases}$

2. $\begin{cases} x=\frac{1}{3} \\ y=-\frac{1}{2} \end{cases}$

3. $\begin{cases} x=-2 \\ y=5 \end{cases}$

4. $\begin{cases} x=2 \\ y=3 \end{cases}$

5. $\begin{cases} x=2 \\ y=4 \end{cases}$

6. $\begin{cases} a=3 \\ b=2 \end{cases}$

7. $\begin{cases} m=-1 \\ n=4 \end{cases}$

8. $\begin{cases} x=-1 \\ y=2 \end{cases}$

9. $\begin{cases} u=\frac{2}{3} \\ v=\frac{1}{4} \end{cases}$

10. Conjunto infinito de soluciones

11. No hay solución

12. No hay solución

EJERCICIO 83

1. $\begin{cases} x=-4 \\ y=-2 \end{cases}$
2. $\begin{cases} m=-3 \\ n=-4 \end{cases}$
3. $\begin{cases} r=-1 \\ t=1 \end{cases}$
4. $\begin{cases} x=\frac{1}{3} \\ y=3 \end{cases}$
5. $\begin{cases} p=\frac{3}{2} \\ q=\frac{4}{3} \end{cases}$
6. $\begin{cases} x=8 \\ y=-2 \end{cases}$
7. $\begin{cases} p=-4 \\ q=0 \end{cases}$
8. $\begin{cases} x=12 \\ y=9 \end{cases}$
9. Conjunto infinito de soluciones
10. No hay solución
11. Conjunto infinito de soluciones
12. No hay solución

EJERCICIO 84

1. $\begin{cases} x=3 \\ y=-4 \end{cases}$
2. $\begin{cases} m=\frac{3}{2} \\ n=\frac{1}{2} \end{cases}$
3. $\begin{cases} a=-2 \\ b=1 \end{cases}$
4. $\begin{cases} x=-3 \\ y=4 \end{cases}$
5. $\begin{cases} p=-1 \\ q=1 \end{cases}$
6. $\begin{cases} x=-4 \\ y=0 \end{cases}$
7. $\begin{cases} a=-1 \\ b=3 \end{cases}$
8. $\begin{cases} m=\frac{2}{3} \\ n=\frac{1}{5} \end{cases}$
9. $\begin{cases} u=\frac{5}{6} \\ v=-\frac{2}{3} \end{cases}$
10. Conjunto infinito de soluciones
11. No hay solución
12. No hay solución

EJERCICIO 85

1. 23
2. 62
3. 0
4. 39
5. $\frac{9}{4}$
6. $\frac{73}{30}$
7. $2ab-a^2$
8. n^2-3mn
9. $-\frac{7}{9}$
10. $\frac{a+b}{a}$
11. $\frac{x-2}{x+5}$

EJERCICIO 86

1. $\begin{cases} x=-3 \\ y=-6 \end{cases}$
2. $\begin{cases} m=-2 \\ n=-3 \end{cases}$
3. $\begin{cases} a=-2 \\ b=5 \end{cases}$
4. $\begin{cases} x=-7 \\ y=-1 \end{cases}$
5. $\begin{cases} p=2 \\ q=3 \end{cases}$
6. $\begin{cases} x=-\frac{2}{3} \\ y=-\frac{7}{2} \end{cases}$
7. $\begin{cases} a=2 \\ b=0 \end{cases}$
8. $\begin{cases} m=\frac{9}{5} \\ n=-\frac{1}{3} \end{cases}$
9. Conjunto infinito de soluciones
10. No hay solución
11. No hay solución
12. Conjunto infinito de soluciones

EJERCICIO 87

1. $\begin{cases} x=-1 \\ y=2 \end{cases}$
2. $\begin{cases} a=-3 \\ b=4 \end{cases}$
3. $\begin{cases} m=-2 \\ n=-2 \end{cases}$
4. $\begin{cases} x=1 \\ y=2 \end{cases}$
5. $\begin{cases} m=3 \\ n=5 \end{cases}$
6. $\begin{cases} x=\sqrt{3} \\ y=\sqrt{2} \end{cases}$
7. $\begin{cases} x=-5 \\ y=4 \end{cases}$
8. $\begin{cases} x=\frac{2}{5} \\ y=\frac{1}{2} \end{cases}$
9. $\begin{cases} x=6 \\ y=5 \end{cases}$
10. $\begin{cases} x=-1 \\ y=2 \end{cases}$
11. $\begin{cases} x=4 \\ y=-1 \end{cases}$
12. $\begin{cases} p=5 \\ q=-1 \end{cases}$
13. $\begin{cases} x=2 \\ y=-3 \end{cases}$
14. $\begin{cases} x=3 \\ y=-7 \end{cases}$
15. $\begin{cases} a=1 \\ b=-2 \end{cases}$
16. $\begin{cases} m=\frac{1}{3} \\ n=\frac{1}{2} \end{cases}$
17. $\begin{cases} x=\frac{1}{3} \\ y=-\frac{1}{2} \end{cases}$
18. $\begin{cases} x=2 \\ y=5 \end{cases}$
19. $\begin{cases} x=-\frac{1}{2} \\ y=-\frac{1}{4} \end{cases}$
20. $\begin{cases} x=\frac{1}{10} \\ y=\frac{1}{5} \end{cases}$
21. $\begin{cases} x=b \\ y=a \end{cases}$
22. $\begin{cases} x=a^2 \\ y=b^2 \end{cases}$
23. $\begin{cases} x=a+b \\ y=a-b \end{cases}$
24. $\begin{cases} x=\sqrt{a} \\ y=\sqrt{b} \end{cases}$

EJERCICIO 88

1. $\begin{cases} 180 \\ 45 \end{cases}$
2. $\begin{cases} 140° \\ 40° \end{cases}$
3. $\begin{cases} 80 \\ 50 \end{cases}$
4. $\begin{cases} \frac{1}{8} \\ \frac{1}{6} \end{cases}$
5. $\begin{cases} \text{\$80 por adulto} \\ \text{\$50 por niño} \end{cases}$
6. 5 monedas de $10
7. $\begin{cases} \text{Lados iguales} = 19 \text{ cm} \\ \text{Base} = 10 \text{ cm} \end{cases}$
8. $\begin{cases} \text{Agenda} = \text{\$750} \\ \text{Traductor} = \text{\$550} \end{cases}$
9. $\begin{cases} \text{Hermano} = 15 \text{ años} \\ \text{Antonio} = 5 \text{ años} \end{cases}$
10. $\begin{cases} 73 \\ 65 \end{cases}$
11. $\begin{cases} \text{Carlos tenía \$300} \\ \text{Gabriel tenía \$200} \end{cases}$
12. $\begin{cases} \text{Primera parte} = 350 \\ \text{Segunda parte} = 200 \end{cases}$
13. $\begin{cases} 14 \\ 70 \end{cases}$
14. $\begin{cases} 7 \\ 45 \end{cases}$
15. $\begin{cases} \text{Alejandra tiene} = \text{\$120} \\ \text{Beatriz tiene} = \text{\$50} \end{cases}$
16. Lancha: 10 km/h
    Corriente: 1 km/h
17. $\begin{cases} \text{25 gallinas} \\ \text{19 borregos} \end{cases}$
18. $\begin{cases} \text{Gallinas} = \text{\$30} \\ \text{Borregos} = \text{\$300} \end{cases}$
19. $\begin{cases} \text{Álgebra L.} = \text{\$120} \\ \text{Geometría A.} = \text{\$90} \end{cases}$
20. $\begin{cases} \text{12.5 lt de la de 30\%} \\ \text{37.5 lt de la de 6\%} \end{cases}$
21. $\begin{cases} \text{Veracruz} = 0.75 \text{ kg} \\ \text{Chiapas} = 0.25 \text{ kg} \end{cases}$

EJERCICIO 89

1. $\begin{cases} x=7 \\ y=3 \\ z=1 \end{cases}$

2. $\begin{cases} d=6 \\ e=-2 \\ f=3 \end{cases}$

3. $\begin{cases} x=3 \\ y=-3 \\ z=\frac{1}{3} \end{cases}$

4. $\begin{cases} x=\frac{2}{3} \\ y=\frac{1}{5} \\ z=-1 \end{cases}$

5. $\begin{cases} m=-3 \\ n=-2 \\ r=-1 \end{cases}$

6. $\begin{cases} a=\frac{1}{4} \\ b=\frac{1}{3} \\ c=\frac{1}{2} \end{cases}$

7. $\begin{cases} x=8 \\ y=6 \\ z=4 \end{cases}$

8. $\begin{cases} a=5 \\ b=-2 \\ c=-3 \end{cases}$

9. $\begin{cases} m=7 \\ n=3 \\ r=1 \end{cases}$

10. $\begin{cases} x=-4 \\ y=3 \\ z=2 \end{cases}$

11. $\begin{cases} x=3 \\ y=4 \\ z=5 \end{cases}$

12. $\begin{cases} a=\frac{1}{3} \\ b=\frac{1}{2} \\ c=1 \end{cases}$

EJERCICIO 90

1. $\begin{cases} \text{Paleta}=\$2 \\ \text{Helado}=\$4 \\ \text{Dulce}=\$1 \end{cases}$

2. $\begin{cases} \text{Camisa}=\$300 \\ \text{Pantalón}=\$500 \\ \text{Playera}=\$400 \end{cases}$

3. $\begin{cases} \text{Pares de calcetas}=\$50 \\ \text{Pantalón}=\$550 \\ \text{Playera}=\$120 \end{cases}$

4. $\begin{cases} \text{Centenas}=8 \\ \text{Decenas}=6 \\ \text{Unidades}=2 \\ \text{Número}=862 \end{cases}$

EJERCICIO 91

1. $\frac{2}{x+1}+\frac{3}{x-1}$
2. $\frac{7}{3x-7}+\frac{5}{2x-3}$
3. $\frac{1}{5x-4}-\frac{1}{5x+4}$
4. $\frac{2}{x+2}-\frac{1}{x-5}$
5. $-\frac{3}{x-7}-\frac{1}{x-4}$
6. $\frac{8}{2x-1}-\frac{6}{2x+1}$
7. $\frac{1}{x+3}+\frac{1}{x+2}$
8. $\frac{3}{2x+5}-\frac{2}{3x-1}$
9. $\frac{3}{4-x}-\frac{2}{x+3}$
10. $\frac{1}{2x+7}+\frac{5}{x-2}$
11. $\frac{1}{3x-2}-\frac{3}{(3x-2)^2}$
12. $\frac{2}{x}-\frac{1}{x+2}+\frac{3}{x-3}$
13. $\frac{2}{x-2}-\frac{1}{x+1}+\frac{1}{x+4}$
14. $\frac{1}{x+3}+\frac{2}{x-2}-\frac{3}{(x-2)^2}$
15. $\frac{5}{x}+\frac{4}{2x-1}+\frac{1}{x-3}$
16. $\frac{2}{x}+\frac{3}{x-1}+\frac{4}{x+2}$
17. $\frac{1}{2x+3}-\frac{1}{3x-2}-\frac{5}{x}$
18. $\frac{3}{x+1}+\frac{1}{x+3}-\frac{2}{x-2}$
19. $\frac{2}{x+1}-\frac{6}{2x+1}+\frac{3}{x-2}$
20. $\frac{2}{(x+1)^2}-\frac{1}{x+1}-\frac{1}{(x+1)^3}$
21. $\frac{1}{x}+\frac{1}{(x-1)^3}-\frac{3}{(x-1)^2}-\frac{2}{x-1}$
22. $\frac{1}{(x+3)^2}+\frac{1}{x+3}-\frac{1}{(x-3)^2}+\frac{1}{x-3}$

EJERCICIO 92

1. $\frac{3}{x}+\frac{x+1}{x^2-3}$
2. $\frac{1}{x+1}+\frac{x-2}{3x^2+1}$
3. $\frac{1}{x-2}+\frac{x-1}{x^2+1}$
4. $\frac{2}{x^2+5}-\frac{1}{x^2-7}$
5. $\frac{1}{x-1}+\frac{2x+3}{x^2+x+1}$
6. $\frac{x+1}{x^2+5}-\frac{7x}{x^2+3}$
7. $\frac{1}{x}-\frac{x+3}{x^2-2}+\frac{x+1}{x^2+3}$
8. $\frac{5}{x-3}+\frac{1}{x^2-2x-1}$
9. $\frac{x-3}{2x^2-7}+\frac{5x-1}{x^2+5}$
10. $\frac{x-2}{x^2+5x-3}-\frac{8}{x}$
11. $\frac{3x-1}{x^2+4x+5}-\frac{1}{2x-4}$

12. $\frac{1}{x}+\frac{x+1}{\left(x^2-3\right)^2}+\frac{1}{x^2-3}$

13. $\frac{x}{x^2+x-1}+\frac{2x+1}{\left(x^2+x-1\right)^2}$

14. $\frac{x-3}{\left(x^2+1\right)^3}+\frac{1}{\left(x^2+1\right)^2}-\frac{5}{x^2+1}$

15. $\frac{2}{x+1}+\frac{1}{\left(x^2-2\right)^2}-\frac{1}{x^2-2}$

16. $\frac{x+1}{x^2+3x+4}-\frac{1}{\left(x^2+3x+4\right)^2}+\frac{1}{x}$

17. $\frac{2}{x^2}-\frac{1}{x}+\frac{1}{\left(x^2+1\right)^2}-\frac{1}{x^2+1}$

18. $\frac{1}{x^4}-\frac{1}{\left(x^2+2\right)^2}$

19. $\frac{1}{\left(x^2-2\right)^2}+\frac{3x+1}{x^2-2}-\frac{1}{x^2+1}$

20. $\frac{5x+17}{3\left(x^2-x+1\right)^2}+\frac{14-34x}{9\left(x^2-x+1\right)}+\frac{16}{9\left(x+1\right)}+\frac{4}{x-1}$

CAPÍTULO 9

EJERCICIO 93

1. $27x^6$
2. $16x^2y^2$
3. $\frac{16}{625}a^{16}$
4. $-216x^6y^9$
5. $-32a^{30}$
6. $\frac{49}{16}m^{-4}$
7. $\frac{32a^5}{b^5}$
8. $16a^4x^4$
9. $-15y^3$
10. xy^7
11. x
12. $-mn$
13. a^8
14. $\frac{9}{m^6}$
15. $\frac{3a^2}{b}$
16. $\frac{m^5}{n^3}$
17. $\frac{3}{17a^4b}$
18. $\frac{x^4}{y}$
19. $-\frac{1}{243}m^{10}$
20. $16x^4$
21. -9
22. 2
23. $\frac{5}{x^3}$
24. $-\frac{1}{36x^2}$
25. $\frac{a^3}{b^2}$
26. $\frac{1}{b^{12}}$
27. $\frac{1}{z^3}$
28. $(x+2y)^6$
29. $108a^9$
30. $\frac{y^9}{12x^4}$
31. $-\frac{2}{x^9}$
32. 1
33. a^2b^2
34. $72a^{13}$

EJERCICIO 94

1. $x^9y^8z^6$
2. $\frac{y}{x^{\frac{3}{4}}}$
3. $x^{\frac{1}{4}}y^{\frac{1}{2}}$
4. $\frac{1}{4z^4}$
5. $\frac{2x^2}{y^4}$
6. c
7. $6x^2y^5$
8. $16ab^2$
9. $\frac{y^{12}}{4x^{10}z^{14}}$
10. 1
11. $\left(x+3y\right)^{\frac{7}{6}}$
12. $\frac{y^{12}}{64x^3}$
13. $\frac{a^3b^2}{c}$
14. $\frac{y^6}{x^7}$
15. $\frac{y^2}{x^{10}z^5}$
16. $\frac{c^4}{a^2b^4}$
17. $\frac{9ab^{12}}{8}$
18. m^3n^7
19. $16y^{20}$
20. x^2+y^2
21. $(x-2y)^2$
22. $\frac{b^3-a^3}{a^3+b^3}$
23. $\frac{1}{y-x}$
24. $\frac{y}{y+1}$
25. $\frac{y^6-x^4}{x^4y^6}$
26. $x+y$
27. $\frac{x^2-xy+y^2}{xy}$

EJERCICIO 95

1. $27-54x+36x^2-8x^3$
2. $1+4x+6x^2+4x^3+x^4$
3. $x^3-6x^2y+12xy^2-8y^3$
4. $1+\frac{3x}{2}+\frac{3x^2}{4}+\frac{x^3}{8}$
5. $x^6-6x^5+15x^4-20x^3+15x^2-6x+1$
6. $16-32x+24x^2-8x^3+x^4$
7. $x^{10}+5x^8y^2+10x^6y^4+10x^4y^6+5x^2y^8+y^{10}$
8. $\frac{x^5}{32}-\frac{5x^4}{16}+\frac{5x^3}{4}-\frac{5x^2}{2}+\frac{5x}{2}-1$
9. $\frac{1}{81}-\frac{2x}{27}+\frac{x^2}{6}-\frac{x^3}{6}+\frac{x^4}{16}$
10. $x^9+15x^6y^3+75x^3y^6+125y^9$
11. $\frac{1}{x^2}+\frac{1}{x^4}+\frac{1}{x^6}+\frac{1}{x^8}+\frac{1}{x^{10}}+\ldots$
12. $\frac{1}{8x^3}+\frac{3}{16x^4}+\frac{3}{16x^5}+\frac{5}{32x^6}+\frac{15}{128x^7}+\ldots$
13. $\frac{1}{x^4}+\frac{4}{x^5}+\frac{10}{x^6}+\frac{20}{x^7}+\frac{35}{x^8}+\ldots$
14. $\left(3x\right)^{\frac{1}{3}}+\frac{1}{3\left(3x\right)^{\frac{2}{3}}}-\frac{1}{9\left(3x\right)^{\frac{5}{3}}}+\frac{5}{81\left(3x\right)^{\frac{8}{3}}}-\frac{10}{243\left(3x\right)^{\frac{11}{3}}}+\ldots$
15. $x^{\frac{4}{3}}+\frac{8x^{\frac{1}{3}}}{3}+\frac{8}{9x^{\frac{2}{3}}}-\frac{32}{81x^{\frac{5}{3}}}+\frac{80}{243x^{\frac{8}{3}}}+\ldots$
16. $\frac{1}{x^{\frac{3}{4}}}+\frac{3}{2x^{\frac{7}{4}}}+\frac{21}{8x^{\frac{11}{4}}}+\frac{77}{16x^{\frac{15}{4}}}+\frac{1155}{128x^{\frac{19}{4}}}+\ldots$

EJERCICIO 96

1. $127\,575x^5$
2. $\frac{35}{8}x^4$
3. $-439\,040x^3y^3$
4. $\frac{22}{729(8x)^{\frac{14}{3}}}$
5. $-253\,125\,000x^3$
6. $\frac{1792}{x^9}$
7. $\frac{1}{x^5}$
8. $\frac{729}{512x^{\frac{5}{2}}}$

EJERCICIO 97

1. $16x^4+32x^3+24x^2+8x+1$
2. $2\,187-10\,206y+20\,412y^2-22\,680y^3+15\,120y^4-6\,048y^5+1344y^6-128y^7$
3. $x^8+8x^7+28x^6+56x^5+70x^4+56x^3+28x^2+8x+1$
4. $x^6-6x^5+15x^4-20x^3+15x^2-6x+1$
5. $3\,125m^5-6\,250m^4n+5\,000m^3n^2-2\,000m^2n^3+400mn^4-32n^5$
6. $a^8+16a^7b+112a^6b^2+448a^5b^3+1120a^4b^4+1792a^3b^5+1792a^2b^6+1024ab^7+256b^8$
7. $x^{12}+30x^{10}y+375x^8y^2+2\,500x^6y^3+9\,375x^4y^4+18\,750x^2y^5+15\,625y^6$
8. $\frac{x^7}{128}+\frac{7x^5}{64}+\frac{21x^3}{32}+\frac{35x}{16}+\frac{35}{8x}+\frac{21}{4x^3}+\frac{7}{2x^5}+\frac{1}{x^7}$
9. $x^3+3x^2y-6x^2+3xy^2-12xy+12x+y^3-6y^2+12y-8$
10. $\frac{x^{10}}{y^5}-\frac{5x^7}{y^2}+10x^4y-10xy^4+\frac{5y^7}{x^2}-\frac{y^{10}}{x^5}$
11. $x^{12}-12x^{11}+66x^{10}-220x^9+495x^8-792x^7+924x^6-792x^5+495x^4-220x^3+66x^2-12x+1$
12. $\frac{32}{x^5}+\frac{40}{x^4}+\frac{20}{x^3}+\frac{5}{x^2}+\frac{5}{8x}+\frac{1}{32}$

CAPÍTULO 10

EJERCICIO 98

1. $m^{\frac{5}{2}}$
2. $x^{\frac{2}{7}}$
3. $y^{\frac{4}{3}}$
4. $a^{\frac{2}{5}}$
5. $b^{\frac{11}{2}}$
6. $(5x)^{\frac{1}{2}}$
7. $(2x)^{\frac{5}{6}}$
8. $(3y^2)^{\frac{3}{4}}$
9. $(2xy)^{\frac{9}{2}}$
10. $(x^2y)^{\frac{2}{9}}$
11. $(x^4y^4)^{\frac{1}{8}}$
12. $(x^6+y^6)^{\frac{1}{3}}$
13. $(x^7-y^7)^{\frac{1}{2}}$
14. $(x^2+y^2)^{\frac{4}{3}}$
15. $(x+2y)^{\frac{11}{5}}$
16. $a^{\frac{9}{5}}-b^{\frac{3}{7}}$
17. $\left(x^{\frac{1}{2}}+y^{\frac{1}{2}}\right)^{\frac{5}{2}}$
18. $m^{\frac{7}{4}}n^{\frac{3}{5}}$
19. $m^{\frac{1}{2}}(n+p)^{\frac{3}{2}}$
20. $a^{\frac{2}{3}}m^{\frac{13}{3}}n^{\frac{7}{4}}$

EJERCICIO 99

1. $\sqrt[3]{2}$
2. $\sqrt[7]{5^4}$
3. $\sqrt[3]{m^2}$
4. $\sqrt{(3y)^{11}}$
5. $\sqrt[4]{(2xy^2)^3}$
6. $\sqrt{x^3y}$
7. $7\sqrt[5]{y^2}$
8. $3\sqrt[5]{a^3}\,\sqrt[7]{b^8}$
9. $\frac{3}{4}\sqrt[5]{z^2}\,\sqrt[4]{y}$
10. $\sqrt[5]{m^2}-\sqrt[3]{n}$
11. $\sqrt[7]{a}+\sqrt[7]{b}$
12. $\sqrt[3]{x}-\sqrt[4]{y}$
13. $\sqrt[5]{(2x+y)^4}$
14. $\sqrt{m+n}$
15. $\sqrt[3]{(a^3+b^3)^2}$
16. $\sqrt[7]{(m^{-1}-n^{-2})^3}$

EJERCICIO 100

1. 27
2. 2
3. 3
4. 14
5. 4
6. $\frac{9}{4}$
7. 6
8. -8
9. -4
10. $2xy^2$
11. $3m^2n^3$
12. $2x^4$
13. $2x^3y^5$
14. $2m^3n$
15. $\frac{5}{y^{2n}}$
16. $5m^{2-x}n^{4y-3}$
17. $2(1+x)$
18. $|x-y|$
19. $\frac{3x}{2},-\frac{3x}{2}$
20. $\frac{|x+2y|}{|xy|}$

EJERCICIO 101

1. $x\sqrt{x}$
2. $3xy^3\sqrt{3y}$
3. $8mnz^2\sqrt{m}$
4. $3mn^5\sqrt[3]{m^2}$
5. $xyz^2\sqrt[3]{x^2y}$
6. $5xy^2\sqrt[4]{x}$
7. $15a^2b\sqrt{2b}$
8. $15p^2q^3\sqrt{q}$
9. $6xy\sqrt[4]{3xz}$
10. $10bc\sqrt[4]{5a^3b^3}$
11. $6mn^2\sqrt[5]{3m^3n^2}$
12. $2x^2yz^3\sqrt[3]{xy^2}$
13. $-6m^3n^3\sqrt[4]{8mn^2}$
14. $a^2\sqrt{2a}$
15. $5a\sqrt[5]{ab^4}$
16. $\frac{4}{3}mn^3\sqrt[3]{20mp^2}$
17. $xy\sqrt[3]{y}$
18. $\frac{2}{x}\sqrt[4]{x}$
19. $\frac{3x}{y}\sqrt{x}$
20. $\frac{2ab^2}{m}\sqrt[3]{\frac{2a}{3m^2}}$
21. $\frac{xy}{2z^3}\sqrt[4]{x^3y}$
22. $\frac{2ab}{15d^2}\sqrt[3]{\frac{2a^2}{cd}}$
23. $\frac{3}{4}\sqrt[4]{\frac{5}{3}}$
24. $\frac{2}{3}\sqrt[4]{\frac{5}{x^2}}$
25. $3m\sqrt{m-2n}$
26. $|4x^2+5y^3|\sqrt{x}$
27. $3ab\sqrt[3]{a^4-2ab}$
28. $|m-n|\sqrt{m-n}$
29. $3(x^2-y^2)\sqrt[5]{(x^2-y^2)^2}$
30. $\frac{1}{\sqrt[3]{(2-m)^2}};-\frac{1}{\sqrt[3]{(2-m)^2}}$

EJERCICIO 102

1. $\sqrt{45}$
2. $\sqrt{175}$
3. $\sqrt[3]{128}$
4. $\sqrt{\frac{25}{8}}$
5. $\sqrt[5]{\frac{32}{81}}$
6. $\sqrt{x^3}$
7. $\sqrt[3]{8x^5}$
8. $\sqrt[4]{m^{13}n^5}$
9. $\sqrt[4]{x^5y^9}$
10. $\sqrt{50a^5b^6c^3}$
11. $\frac{1}{\sqrt[3]{4a}}$
12. $\sqrt[3]{\frac{4a^2}{5b^2}}$
13. $\sqrt[4]{\frac{27y^7}{128x^2}}$
14. $\sqrt{3ax^2}$
15. $\sqrt[3]{4x}$
16. $\sqrt{4a^3b+4a^2b^2+ab^3}$
17. $\sqrt{\frac{9}{a+b}}$
18. $\sqrt{\frac{x+1}{(x-1)^3}}$
19. $\sqrt[3]{\frac{x^2+2x+4}{x^2-4x+4}}$
20. $\sqrt{2a^3x}$

EJERCICIO 103

1. $5\sqrt{5}$
2. $-6\sqrt[3]{3}$
3. 0
4. $8\sqrt{7}-\sqrt{5}$
5. $-3\sqrt{3}-7\sqrt{2}$
6. $\frac{5}{4}\sqrt{10}+\frac{1}{2}\sqrt{13}$
7. $-\frac{5}{8}\sqrt{6}$
8. $-4\sqrt[3]{m}$
9. $3\sqrt{x}$
10. $\frac{5}{3}\sqrt[4]{xy}$
11. $4\sqrt{7}$
12. $27\sqrt{2}$
13. $-17\sqrt{3}$
14. $8\sqrt{5}+7\sqrt{2}$
15. $-2\sqrt{3}$
16. $\sqrt{2}-10\sqrt{5}$
17. $47\sqrt{5}-50\sqrt{11}$
18. $-2\sqrt{2}+\frac{4}{5}\sqrt{5}$
19. $9\sqrt{7}a^2$
20. $8a\sqrt{b}$
21. $11x\sqrt[3]{3x}$
22. $-14x^2\sqrt[4]{2}$
23. $3ay\sqrt{x}$
24. $\frac{11}{6}ab\sqrt{2b}+\frac{13}{4}ab\sqrt{3b}$
25. $\frac{17}{12}a^2b\sqrt{c}$
26. $-\frac{23}{24}a^2b\sqrt[4]{2ab}$
27. $10x\sqrt{y}-7x^2\sqrt{2y}$
28. $-xy^2\sqrt{xy}-x^2y\sqrt{3x}$
29. $x\sqrt{2y}+4y\sqrt{3x}$
30. $-2ab\sqrt{2c}+16ac\sqrt{3b}$
31. $-2x\sqrt[3]{y^2}-3y\sqrt[3]{4x}$
32. $10ab\sqrt[4]{5a^2b^3}-6a^2b^3\sqrt[4]{3ab^2}$
33. $\frac{1}{3}a\sqrt{5a}-\frac{1}{3}b\sqrt{3ab}$
34. $\frac{19}{20}x\sqrt[3]{y}+\frac{5}{12}xy\sqrt[3]{xy^2}$
35. $-\frac{1}{9}a^3b\sqrt{\frac{2a}{b}}+\frac{2}{3}ab^3\sqrt{\frac{5a}{3}}$
36. $6\sqrt{a-2}$
37. $-x\sqrt{x+2}$
38. $10xy\sqrt{x-3y}$

EJERCICIO 104

1. $3\sqrt{2}$
2. $5\sqrt{6}$
3. $2\sqrt[3]{9}$
4. $27\sqrt{10}$
5. xy^2
6. $xy\sqrt[3]{xy^2}$
7. $\frac{2}{15}x^3$
8. $18a^2b\sqrt{2b}$
9. $2xy^3\sqrt{3xy}$
10. $a^4\sqrt{a}$
11. $2a^2\sqrt[4]{a}$
12. $-8ab^2\sqrt[3]{6b}$
13. $6a\sqrt{a}$
14. $8x\sqrt[4]{x^3}$
15. $-6a^3b^3\sqrt{2b}$
16. $\frac{3a}{5x}\sqrt{\frac{2a}{x}}$
17. $\frac{2x}{am^2}\sqrt{3}$
18. $6-4\sqrt{6}$
19. $5-\sqrt[3]{25}$
20. $\frac{8}{3}x^2\sqrt{2}-x$
21. $19-8\sqrt{3}$
22. 95
23. $2m-3n\sqrt{2m}-4n^2$
24. $x-y$
25. $|x+y|\sqrt{x-y}$
26. $\sqrt{x^2-y}$
27. $|1-x|$
28. $\sqrt[3]{3}(x-y)$
29. $|x+y|\sqrt{x-y}$
30. 1

EJERCICIO 105

1. $\sqrt[6]{18}$
2. $x\sqrt{x}$
3. $\sqrt[16]{x^{15}}$
4. $xy\sqrt[6]{108x^3y^2}$
5. $3x^2y\sqrt[4]{x^3}$
6. $a\sqrt[4]{4ab^3}$
7. $x\sqrt[6]{72x}$
8. $\sqrt[6]{2x^5y^5}$
9. $a\sqrt[12]{a}$
10. $x\sqrt[6]{x^5}$
11. $y\sqrt[6]{y}$
12. $\frac{1}{y}\sqrt[3]{2xy}$
13. $\frac{3}{2}\sqrt[9]{8mn^2}$
14. $\frac{3}{2}x^2\sqrt[10]{16xy^4}$
15. $\sqrt[12]{x^4y^3z^2}$

EJERCICIO 106

1. $n\sqrt{m}$
2. $xy^2\sqrt[6]{xy}$
3. $3a^3b^2c$
4. $4y\sqrt{x}$
5. $3x^2y\sqrt[3]{3y^2}$
6. $6ab$
7. $\frac{2a^3}{5b^4}$
8. $9m^2x^2$
9. $\frac{3n^6}{4m^2}$
10. $\frac{2}{3zw^2}$
11. $\frac{5z^2}{3}$
12. $\frac{2u^3v^2}{5}$
13. $\frac{4a^2}{3b^2}$
14. $\frac{3x^3}{2y^4}$
15. $\frac{2p^4}{3m^3n^2}$
16. $\frac{2n^2}{p^2}$
17. $\frac{3}{2x}\sqrt[18]{y^{13}}$
18. $\frac{5}{2}y^2z$
19. $-\frac{5n}{4m^2}\sqrt[3]{n^2}$
20. $\frac{y^4x^4}{2}$

EJERCICIO 107

1. $\frac{1}{\sqrt[6]{6}}$
2. $\sqrt[3]{\frac{4}{y}}$
3. $\sqrt[6]{\frac{2y^2}{3}}$
4. $8\sqrt[3]{\frac{b}{a^2}}$
5. $\sqrt[15]{\frac{32a}{b}}$
6. $2\sqrt[6]{\frac{9}{8a}}$
7. $a\sqrt[9]{a}$
8. $a\sqrt[6]{108ab^4}$
9. $\frac{1}{\sqrt[6]{xy}}$
10. $\frac{1}{x\sqrt[4]{x}}$
11. $\sqrt[6]{\frac{4x}{y^4}}$
12. $\sqrt[n^2+n]{x}$
13. $\sqrt[n^2+n]{x+1}$
14. $\sqrt[6]{x-1}$
15. $\sqrt[12]{(a-b)^5}$

EJERCICIO 108

1. $\frac{\sqrt{3}}{3}$
2. $\frac{2\sqrt{5}}{5}$
3. $\frac{\sqrt[3]{300}}{6}$
4. $3\sqrt[3]{x}$
5. $2x\sqrt{3xy}$
6. $\frac{1}{xy}\sqrt[4]{8x^3y^3}$
7. $\frac{3}{2}\sqrt[5]{16a^4}$
8. $\frac{1}{b}\sqrt[3]{3a^2b^2}$
9. $\frac{1}{4x^2}\sqrt{6xy}$
10. $\frac{2}{5ab}\sqrt[4]{25a^3b^2}$
11. $\frac{1}{11}\left(1+2\sqrt{3}\right)$
12. $\frac{2}{7}\left(3+\sqrt{2}\right)$
13. $\frac{5x+\sqrt{5x}}{1-5x}$
14. $\sqrt{3}-2$
15. $\frac{1}{10}\left(4-\sqrt{6}\right)$
16. $\sqrt{3a}+\sqrt{2b}$
17. $\left(1+x\right)\left(1-\sqrt{x}\right)$
18. $\frac{2xy\left(\sqrt[3]{x^2}-\sqrt[3]{xy}+\sqrt[3]{y^2}\right)}{x+y}$
19. $-\left(1+\sqrt[3]{x}+\sqrt[3]{x^2}\right)$
20. $\sqrt[3]{9a^2}-\sqrt[3]{3ab}+\sqrt[3]{b^2}$

EJERCICIO 109

1. $\frac{3}{\sqrt{3}}$
2. $\frac{10}{\sqrt{2}}$
3. $\frac{2}{\sqrt[4]{8}}$
4. $\frac{x}{\sqrt[6]{x^5}}$
5. $\frac{1}{2y\sqrt[3]{x^2y^2}}$
6. $\frac{1}{3\sqrt[4]{x^3}}$
7. $\frac{3}{2\sqrt{6x}}$
8. $\frac{1}{2\sqrt[3]{4x}}$
9. $\frac{2}{x\sqrt[5]{2x^2}}$
10. $\frac{x}{2y\sqrt{3x}}$
11. $\frac{7}{7-2\sqrt{7}}$
12. $\frac{1}{5+\sqrt{2}}$
13. $\frac{1}{5+2\sqrt{6}}$
14. $-\frac{1}{\left(x+3\right)\left(\sqrt{x}+\sqrt{3}\right)}$
15. $\frac{x-y}{x+3\sqrt{xy}+2y}$
16. $\frac{1}{2\left(\sqrt{5x}+\sqrt{6y}\right)}$
17. $\frac{x-5}{\sqrt{x}+\sqrt{5}}$
18. $\frac{1}{\sqrt[3]{x^2}+3\sqrt[3]{x}+9}$
19. $\frac{1}{\sqrt[3]{a^2}+2\sqrt[3]{ab}+4\sqrt[3]{b^2}}$
20. $-\frac{1}{\left(y+2\right)\left(\sqrt[3]{y^2}+\sqrt[3]{2y}+\sqrt[3]{4}\right)}$

CAPÍTULO 11

EJERCICIO 110

1. $4i$
2. $6i$
3. $7i$
4. $11i$
5. $25i$
6. $2\sqrt{2}i$
7. $5\sqrt{2}i$
8. $3\sqrt{6}i$
9. $5\sqrt{5}i$
10. $9\sqrt{2}i$
11. $\frac{2}{7}\sqrt{3}i$
12. $\frac{5}{2}\sqrt{3}i$
13. $3+6i$
14. $2-4\sqrt{7}i$
15. $\frac{2}{3}+\frac{1}{2}\sqrt{5}i$
16. $\frac{4}{5}-2\sqrt{2}i$

EJERCICIO 111

1. $9i$
2. $3+i$
3. $-9i$
4. $11i$
5. $6\sqrt{6}i$
6. 0
7. $-4\sqrt{2}i+3\sqrt{3}i$
8. $\frac{1}{2}\sqrt{3}i+\frac{5}{2}\sqrt{2}i$
9. $11-i$
10. 7
11. 0
12. 0
13. $5\sqrt[4]{i}$
14. $\frac{23}{12}x\sqrt{\sqrt{x}i}$

EJERCICIO 112

1. -1
2. $-i$
3. $-3i$
4. -1
5. i
6. i
7. $-i$
8. $3i-2$
9. $4i$
10. 1
11. $3i-2$
12. 0
13. -1
14. Si n es par: 0
    Si n es impar: $-i$
15. 0

EJERCICIO 113

1. -9
2. $-12\sqrt{3}i$
3. $-4\sqrt{3}i$
4. -2
5. $-\frac{3}{2}-\frac{5}{4}i$
6. $-\frac{18}{5}$
7. -60
8. $-6-3\sqrt{6}$
9. $4i$
10. 3
11. $\frac{2}{5}$
12. $\sqrt{2}-4$
13. $\frac{9}{10}i$
14. $\frac{6}{5}$
15. 0
16. 0
17. $\frac{1}{4}$
18. $-i^n$
19. $2i$
20. $-i$

EJERCICIO 114

1. $\left(2,3\right)$
2. $-1+5i$
3. $\left(0,7\right)$
4. $\left(\frac{2}{3},-\frac{5}{4}\right)$
5. $\left(5,-2\right)$
6. $\frac{1}{2}-\frac{6}{7}i$
7. $-2i$
8. $\left(-\frac{1}{3},0\right)$
9. 3
10. $\left(5,-\frac{2}{11}\right)$
11. $\frac{5}{2}-8i$
12. $\left(1,-1\right)$

EJERCICIO 115

1. $(10, 1)$
2. $(1, 0)$
3. $(-2, -5)$
4. $(5, -6)$
5. $\left(\frac{31}{20},-\frac{1}{3}\right)$
6. $\left(0,1\right)$
7. $\left(\frac{4}{5},-\frac{1}{2}\right)$
8. $\left(\sqrt{2},-5\right)$
9. $\left(\sqrt{3},\sqrt{2}\right)$

10. $7 - i$
11. 6
12. 0
13. $-1 + 11i$
14. $3i$
15. $11 - \frac{7}{2}i$
16. $4 - 10i$
17. 1
18. $-\frac{1}{2} + \frac{19}{6}i$
19. $4 - 3i$
20. $16 - 4i$
21. $2 + 3i$
22. $4 + 5i$

EJERCICIO 116

1. $-17 + 6i$
2. $5 + i$
3. $6 + 4i$
4. $1 - 3i$
5. $-3 + 4i$
6. $-1 + 2\sqrt{6}i$
7. $\frac{13}{6}i$
8. $-2 + \frac{\sqrt{2}}{2}i$
9. $6 + 18i$
10. $-2 + 10i$
11. $-\frac{14}{3} + 4i$
12. i
13. $-8 - 6i$
14. $\frac{39}{400} - \frac{1}{5}i$
15. $32 - 126i$
16. 4
17. $-5 + 13i$
18. $-3 + 4i$

19. $(a + bi)(a - bi) = a^2 - b^2 i^2 = a^2 + b^2$

$= \text{Re}(z)^2 + \text{Im}(z)^2$

20. $(1 + i)^n \cdot (1 - i)^n = (1 - i^2)^n = (1 + 1)^n$

$= \left[\text{Re}(z_1) + \text{Re}(z_2)\right]^n$

21. $w^{2n} = (1 + i)^{2n} = \left[(1 + i)^2\right]^n = (2i)^n$ si n es par,

entonces $n = 2k$ con $k \in Z$, sustituyendo:

$(2i)^n = (2i)^{2k} = (4i^2)^k = (-4)^k = (-1 \cdot 4)^k$

$= (-1)^k \cdot (4)^k$

$= (-1)^{\frac{n}{2}}(2)^{2k}$

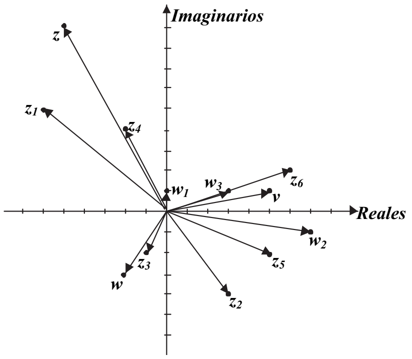
$= (-1)^{\frac{n}{2}}(2, 0)^n$

22. $w^{2n} = (1 + i)^{2n} = \left[(1 + i)^2\right]^n = (2i)^n = (0, 2)^n$

EJERCICIO 117

1. $\frac{i - 2}{5}$
2. $\frac{5 - 12i}{13}$
3. $-3 - i$
4. $\frac{-1 - 2\sqrt{6}i}{5}$
5. $\frac{-4 - \sqrt{2}i}{2}$
6. $1 + i$
7. $\frac{3 + i}{2}$
8. $\frac{-1 + 8i}{5}$
9. $\frac{-2 + 3i}{2}$
10. $\frac{-13 - 9i}{5}$
11. $\frac{-2 + 11i}{25}$
12. $\frac{-129 - 107i}{10}$
13. $\frac{4\sqrt{2} - 4i}{3}$
14. $-i$

EJERCICIO 118



EJERCICIO 119

1. $\sqrt{13}$
2. $\sqrt{41}$
3. $\sqrt{41}$
4. 3
5. $\sqrt{5}$
6. $\sqrt{85}$
7. $\frac{3}{2}$
8. $\sqrt{5}$
9. $\sqrt{2}$
10. $\sqrt{\frac{79}{3}}$
11. $\frac{2}{3}\sqrt{13}$
12. $\sqrt{11}$
13. $5 - 4i$
14. -5
15. $1 - i$
16. $-5i$
17. $-\frac{1}{2}i$
18. $(2, -1)$
19. $(0, 3)$
20. $-\frac{3}{7} + \frac{2}{5}i$
21. $-2 - 6i$
22. $(-1, 1)$
23. $-2 - \frac{11}{4}i$
24. $\left(-\frac{1}{2}, -\frac{1}{3}\right)$

25 a 30. No se incluye la solución

31. $3 + 2i$
32. $2 - 4i$
33. $1 + 8i$
34. $2 - 9i$
35. 4
36. 11
37. $-4 + 6i$
38. $7 - 6i$
39. $1 + \frac{2}{3}i$
40. $\frac{5}{6}i$
41. $\frac{17 - 7i}{13}$
42. $\frac{2 + i}{5}$
43. 1
44. $\frac{5}{12}$
45. $\frac{i}{4}$

CAPÍTULO 12

EJERCICIO 120

1. $x_1 = -4, x_2 = -1$
2. $x_1 = -9, x_2 = 3$
3. $x_1 = -6, x_2 = -5$
4. $y_1 = 3 + i, y_2 = 3 - i$
5. $w_1 = -5, w_2 = 8$
6. $z_1 = 15, z_2 = -2$
7. $x_1 = 6, x_2 = 4$
8. $x_1 = -20, x_2 = 12$
9. $x_1 = -1 + 2i, x_2 = -1 - 2i$
10. $x_1 = 1, x_2 = -\frac{2}{3}$

11. $x_1=-\frac{1}{2}, x_2=-2$

12. $w_1=\frac{3}{2}, w_2=-\frac{1}{5}$

13. $x_1=3, x_2=-\frac{2}{3}$

14. $x_1=\frac{1}{2}-\frac{1}{3}i, x_2=\frac{1}{2}+\frac{1}{3}i$

15. $x_1=-b, x_2=-\frac{1}{4}b$

16. $w_1=-\frac{3}{7}a,\ w_2=5a$

17. $x_1=-5b, x_2=2b$

18. $x_1=-\frac{5}{b}, x_2=\frac{6}{b}$

19. $y_1=-\frac{2b}{a}, y_2=-\frac{b}{a}$

20. $y_1=\frac{10}{7}a, y_2=\frac{a}{2}$

EJERCICIO 121

1. $x_1 = 3,\ x_2 = 5$
2. $x_1 = 3,\ x_2 = -2$
3. $x_1 = -4,\ x_2 = -2$
4. $x_1 = 5,\ x_2 = -3$
5. $x_1 = \frac{5}{2},\ x_2 = \frac{5}{2}$
6. $x_1 = -\frac{5}{2},\ x_2 = \frac{1}{3}$
7. $y_1 = -\frac{3}{5},\ y_2 = 1$
8. $x_1 = 3-\sqrt{7},\ x_2 = 3+\sqrt{7}$
9. $x_1 = -1-\sqrt{6},\ x_2 = -1+\sqrt{6}$
10. $x_1 = 2-i,\ x_2 = 2+i$
11. $x_1 = -\frac{1}{2}-2i,\ x_2 = -\frac{1}{2}+2i$
12. $x_1 = \frac{1}{3}+\frac{3}{2}i,\ x_2 = \frac{1}{3}-\frac{3}{2}i$
13. $w_1 = 0,\ w_2 = 5$
14. $z_1 = 0,\ z_2 = -\frac{5}{2}$
15. $y_1 = 0,\ y_2 = \frac{a}{3}$
16. $x_1 = 0,\ x_2 = \frac{b}{a}$
17. $x_1 = -5,\ x_2 = 5$
18. $x_1 = -\frac{1}{2},\ x_2 = \frac{1}{2}$
19. $x_1 = -\frac{b}{a}i,\ x_2 = \frac{b}{a}i$
20. $w_1 = -\frac{4}{a},\ w_2 = \frac{4}{a}$

EJERCICIO 122

1. Reales y diferentes
2. Complejas
3. Complejas
4. Reales e iguales
5. Reales y diferentes
6. Complejas
7. Reales y diferentes
8. Complejas
9. Reales y diferentes
10. Reales e iguales
11. Complejas
12. Reales e iguales

EJERCICIO 123

1. $\begin{cases} x_1=-1 \\ x_2=6 \end{cases}$
2. $\begin{cases} x_1=-8 \\ x_2=-3 \end{cases}$
3. $\begin{cases} y_1=-4 \\ y_2=5 \end{cases}$
4. $\begin{cases} x_1=-9 \\ x_2=10 \end{cases}$
5. $\begin{cases} w_1=1 \\ w_2=4 \end{cases}$
6. $\begin{cases} y_1=\frac{5}{3} \\ y_2=2 \end{cases}$
7. $\begin{cases} x_1=1 \\ x_2=-\frac{2}{3} \end{cases}$
8. $\begin{cases} y_1=-4 \\ y_2=\frac{1}{2} \end{cases}$
9. $\begin{cases} x_1=-\frac{2}{3} \\ x_2=3 \end{cases}$
10. $\begin{cases} x_1=-\frac{1}{7} \\ x_2=\frac{5}{2} \end{cases}$
11. $\begin{cases} x_1=-\frac{2}{5} \\ x_2=\frac{1}{4} \end{cases}$
12. $\begin{cases} z_1=\frac{7}{5} \\ z_2=2 \end{cases}$
13. $\begin{cases} w_1=-\frac{1}{2} \\ w_2=\frac{6}{5} \end{cases}$
14. $\begin{cases} x_1=-\frac{3}{2} \\ x_2=\frac{2}{7} \end{cases}$
15. $\begin{cases} x_1=-5 \\ x_2=\frac{3}{2} \end{cases}$
16. $\begin{cases} x_1=-\frac{5}{2}b \\ x_2=\frac{2}{3}b \end{cases}$
17. $\begin{cases} x_1=\frac{ab}{2} \\ x_2=2ab \end{cases}$
18. $\begin{cases} x_1=-\frac{1}{a} \\ x_2=\frac{3}{a} \end{cases}$
19. $\begin{cases} x_1=-\frac{3b}{a} \\ x_2=\frac{2b}{a} \end{cases}$
20. $\begin{cases} z_1=2\sqrt{3} \\ z_2=-\sqrt{3} \end{cases}$
21. $\begin{cases} x_1=-3\sqrt{3} \\ x_2=5\sqrt{3} \end{cases}$
22. $\begin{cases} x_1=2\sqrt{7} \\ x_2=5\sqrt{7} \end{cases}$
23. $\begin{cases} y_1=-\frac{1}{2} \\ y_2=-\frac{1}{15} \end{cases}$
24. $\begin{cases} x_1=\frac{2}{3} \\ x_2=-\frac{1}{4} \end{cases}$
25. $\begin{cases} w_1=-\frac{1}{3} \\ w_2=\frac{2}{5} \end{cases}$

EJERCICIO 124

1. $\begin{cases} x_1=0 \\ x_2=-6 \end{cases}$
2. $\begin{cases} x_1=0 \\ x_2=2 \end{cases}$
3. $\begin{cases} x_1=0 \\ x_2=5 \end{cases}$
4. $\begin{cases} x_1=0 \\ x_2=-\frac{2}{3} \end{cases}$
5. $\begin{cases} x_1=0 \\ x_2=1 \end{cases}$
6. $\begin{cases} x_1=0 \\ x_2=\frac{5}{7} \end{cases}$
7. $\begin{cases} x_1=0 \\ x_2=\frac{1}{2} \end{cases}$
8. $\begin{cases} x_1=0 \\ x_2=-4 \end{cases}$
9. $\begin{cases} x_1=0 \\ x_2=-8 \end{cases}$
10. $\begin{cases} x_1=0 \\ x_2=2 \end{cases}$

EJERCICIO 125

1. $\begin{cases} x_1=-2 \\ x_2=2 \end{cases}$
2. $\begin{cases} x_1=-1 \\ x_2=1 \end{cases}$
3. $\begin{cases} w_1=-10 \\ w_2=10 \end{cases}$
4. $\begin{cases} x_1=-8 \\ x_2=8 \end{cases}$
5. $\begin{cases} y_1=-\sqrt{3} \\ y_2=\sqrt{3} \end{cases}$
6. $\begin{cases} x_1=-\frac{a}{4} \\ x_2=\frac{a}{4} \end{cases}$
7. $\begin{cases} z_1=-\frac{6}{5} \\ z_2=\frac{6}{5} \end{cases}$
8. $\begin{cases} y_1=-6 \\ y_2=6 \end{cases}$
9. $\begin{cases} w_1=-\sqrt{7} \\ w_2=\sqrt{7} \end{cases}$
10. $\begin{cases} x_1=-\sqrt{3} \\ x_2=\sqrt{3} \end{cases}$
11. $\begin{cases} x_1=-\frac{2}{3} \\ x_2=\frac{2}{3} \end{cases}$
12. $\begin{cases} x_1=-1 \\ x_2=1 \end{cases}$
13. $\begin{cases} y_1=-4i \\ y_2=4i \end{cases}$
14. $\begin{cases} w_1=-5i \\ w_2=5i \end{cases}$
15. $\begin{cases} x_1=-i \\ x_2=i \end{cases}$

Ejercicio 126

1. 27 y 15
2. 30 y 12
3. 3, 5 y 7
4. 12, 14 y 16
5. $\frac{1}{5}$ y 5
6. 5 y 20
7. $\begin{cases}\text{largo}=200\text{ m}\\ \text{base}=125\text{ m}\end{cases}$
   $\begin{cases}\text{largo}=250\text{ m}\\ \text{base}=100\text{ m}\end{cases}$
8. $\begin{cases}\text{altura}=10\text{ m}\\ \text{base}=30\text{ m}\end{cases}$
9. 3, 4 y 5
10. 96 m^3
11. $\begin{cases}\text{altura}=18\text{ m}\\ \text{base}=54\text{ m}\end{cases}$
12. $\begin{cases}\text{Alejandro}=8\text{ años}\\ \text{Alfredo}=4\text{ años}\end{cases}$
13. 7
14. $\begin{cases}\text{árboles}=15\\ \text{filas}=13\end{cases}$
15. $r = 4$ cm
16. $\begin{cases}\text{largo}=17\text{ cm}\\ \text{ancho}=16\text{ cm}\end{cases}$
17. 39 años
18. 5 segundos
19. 7.5 segundos
20. $\begin{cases}\text{primera llave}=8\text{ h}\\ \text{segunda llave}=24\text{ h}\end{cases}$
21. $20
22. 8, 6 y 10 unidades

Ejercicio 127

1. $V(2,-2)$ $x_1=1, x_2=3$
2. $V\left(\frac{1}{2},\frac{25}{2}\right)$ $x_1=-2, x_2=3$
3. $V\left(\frac{1}{2},-\frac{81}{4}\right)$ $x_1=-4, x_2=5$
4. $V(-2,-7)$ $x_1=-\sqrt{7}-2, x_2=\sqrt{7}-2$
5. $V(-1,4)$ $x_1=-1+2i, x_2=-1-2i$
6. $V(1,0)$ $x_1=1, x_2=1$
7. $V(2,9)$ $x_1=2+3i, x_2=2-3i$
8. $V(5,0)$ $x_1=5, x_2=5$
9. $V(0,-9)$ $x_1=3i, x_2=-3i$
10. $V\left(\frac{3}{2},-\frac{9}{2}\right)$ $x_1=0, x_2=3$

Ejercicio 128

1. 50 y 50
2. – 10 y 10
3. 20 y 20
4. 55 y 55
5. 72 pies
6. 19 cm y 19 cm
7. 500 ejemplares
8. 20 pelotas
9. 35 cajas
10. $\begin{cases}56.5\text{ cm}\\ 43.5\text{ cm}\end{cases}$

Ejercicio 129

1. $\begin{cases}x_1+x_2=0\\ x_1\cdot x_2=-\frac{9}{4}\end{cases}$
2. $\begin{cases}x_1+x_2=0\\ x_1\cdot x_2=-25\end{cases}$
3. $\begin{cases}x_1+x_2=1\\ x_1\cdot x_2=0\end{cases}$
4. $\begin{cases}x_1+x_2=-\frac{8}{3}\\ x_1\cdot x_2=0\end{cases}$
5. $\begin{cases}x_1+x_2=5\\ x_1\cdot x_2=6\end{cases}$
6. $\begin{cases}x_1+x_2=-4\\ x_1\cdot x_2=3\end{cases}$
7. $\begin{cases}x_1+x_2=1\\ x_1\cdot x_2=-12\end{cases}$
8. $\begin{cases}x_1+x_2=-\frac{1}{2}\\ x_1\cdot x_2=-\frac{1}{2}\end{cases}$
9. $\begin{cases}x_1+x_2=-3\\ x_1\cdot x_2=\frac{14}{9}\end{cases}$
10. $\begin{cases}x_1+x_2=-7a\\ x_1\cdot x_2=12a^2\end{cases}$

Ejercicio 130

1. $x^2-9=0$
2. $x^2+7x=0$
3. $x^2+16=0$
4. $x^2-5x+4=0$
5. $x^2+8x+15=0$
6. $x^2+4x+29=0$
7. $2x^2-5x+2=0$
8. $20x^2+19x+3=0$
9. $x^2+2bx-3b^2=0$
10. $x^2-7ax+10a^2=0$

Ejercicio 131

1. $x=49$
2. $x=-8$
3. $x=\frac{13}{2}$
4. $x=5$
5. $x=5$
6. $x=2$
7. $x=3$
8. $x=7$
9. $x=-1$
10. $x=1$
11. $x=4$
12. $x=1$
13. $x=\frac{1}{256}$
14. $x=1$
15. $x=3$
16. $x=-2,-7$
17. $x=-1,1$
18. $x=9$

Ejercicio 132

1. (0, 0), (4, 4)
2. (0, 3), (3, 0)
3. (3, – 3), (– 3, 3)
4. (2, 4), (– 2, – 4)
5. (– 3, – 5), (5, 3)
6. (3, 2), (– 3, – 1)
7. (4, 3), (4, – 3), (– 4, 3), (– 4, – 3)
8. $\left(\frac{1}{3},0\right),\left(-\frac{1}{3},0\right)$
9. $\left(2, 4\sqrt{2}\right),\left(2, -4\sqrt{2}\right),\left(-2, 4\sqrt{2}\right),\left(-2, -4\sqrt{2}\right)$
10. (7, – 7), (– 7, 7), $\left(2\sqrt{7},\sqrt{7}\right),\left(-2\sqrt{7}, -\sqrt{7}\right)$
11. (4, 2), (– 4, – 2), (5, 1), (– 5, – 1)
12. $(5,1),(-5,-1),\left(-\sqrt{3}, 2\sqrt{3}\right),\left(\sqrt{3}, -2\sqrt{3}\right)$
13. (1, 1),(– 1, – 1), (– 2, 0), (2, 0)
14. (3, 2), (– 3, – 2), (4i, i), (– 4i, – i)
15. $\left(\frac{\sqrt{30}}{5},\frac{2\sqrt{30}}{5}\right),\left(-\frac{\sqrt{30}}{5},-\frac{2\sqrt{30}}{5}\right),(2,-3),(-2,3)$
16. (3, 6), (– 3, – 6)
17. $(2,1),(-2,-1),\left(-\frac{\sqrt{2}}{2},\sqrt{2}\right),\left(\frac{\sqrt{2}}{2},-\sqrt{2}\right)$
18. (– 2, 1), (2, – 1)
19. $(1.\ 0)(-1,0),\left(\frac{5\sqrt{17}}{17},\frac{\sqrt{17}}{17}\right),\left(-\frac{5\sqrt{17}}{17},-\frac{\sqrt{17}}{17}\right)$
20. (– 1, – 4), (2, – 7), (1, 4), (– 2, 7)

Capítulo 13

Ejercicio 133

1. $(3,\infty)$
2. $(-\infty,3)$
3. $(-\infty,-4)$
4. $(-\infty,-1]$
5. $(-\infty,-7)$
6. $\left[-\frac{8}{7},\infty\right)$
7. $\left(\frac{3}{2},\infty\right)$
8. $(-\infty,2)$
9. $(-\infty,10]$
10. $(-\infty,5]$
11. $\left(\frac{5}{3},\infty\right)$
12. $\left(-\infty,\frac{8}{53}\right]$
13. $\left(\frac{4}{5},\infty\right)$
14. $\left(-\infty,-\frac{1}{23}\right)$
15. $(2,\infty)$
16. $(6,\infty)$
17. $[-21,\infty)$
18. $[6,\infty)$
19. $(-\infty,-6]$
20. $\left[-\frac{19}{28},\infty\right)$
21. $\left(\frac{18}{5},\infty\right)$
22. $(-\infty,13]$
23. $(-2,3)$
24. $\left(-\frac{3}{2},\frac{7}{2}\right)$
25. $[-3,-1]$
26. $[-9,-1)$
27. $(-3,3)$
28. $[-23,-10)$
29. $(-2,4)$
30. $[-4,1)$
31. $(-1000,100)$
32. $\left[\frac{2}{5},\frac{3}{5}\right]$
33. $[-16,8)$
34. $\left(-\frac{21}{2},\frac{11}{2}\right)$
35. $\left(-\frac{1}{2},\frac{19}{2}\right]$
36. $\left[-\frac{10}{3},\frac{32}{3}\right]$
37. $(-14,-2)$
38. $[-2,4]$
39. $\left[\frac{9}{2},\frac{19}{2}\right]$
40. $\left(\frac{14}{9},\frac{8}{3}\right)$

Ejercicio 134

1. $(-3,3)$
2. $[-4,4]$
3. $(-\infty,-5]\cup[5,\infty)$
4. $(-\infty,-6)\cup(6,\infty)$
5. $\left[0,\frac{1}{3}\right]$
6. $(-\infty,0)\cup(5,\infty)$
7. $(-\infty,0)\cup(4,\infty)$
8. $(-\infty,-4)\cup(5,\infty)$
9. $\left(-\frac{1}{2},3\right)$
10. $\left[-\frac{1}{3},\frac{3}{2}\right]$
11. $(-\infty,-4)\cup(-1,\infty)$
12. $(-\infty,-1]\cup\left[\frac{3}{4},\infty\right)$
13. $\left(-\frac{2}{3},1\right)$
14. $\left(-\infty,-\frac{1}{2}\right]\cup[3,\infty)$

Ejercicio 135

1. $\left(\frac{3}{4},\infty\right)$
2. $\left(-\infty,\frac{5}{2}\right)$
3. $\left(2,\frac{5}{2}\right)$
4. $(-\infty,2)\cup(2,\infty)$
5. $(-\infty,3)$
6. $[-3,2)$
7. $(-\infty,-1]\cup(3,\infty)$
8. $(-1,3)\cup(11,\infty)$
9. $\left[-9,-\frac{1}{3}\right)\cup(4,\infty)$
10. $(-\infty,-2)\cup(2,4]$
11. $(-4,-2)\cup(1,\infty)$
12. $(-\infty,-2)\cup\left[\frac{3}{2},4\right)$
13. $(-\infty,-6)\cup(1,4]$

Ejercicio 136

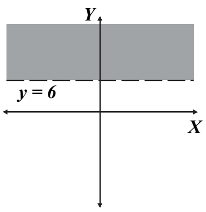
1. $[-2,-1]\cup[2,4]$
2. $[2,\infty)\cup\{-2\}$
3. $(-\infty,-2)\cup(-1,1)$
4. $(-\infty,-4)$
5. $(-3,0)\cup(3,\infty)$
6. $(-\infty,-2)\cup(4,\infty)$

Ejercicio 137

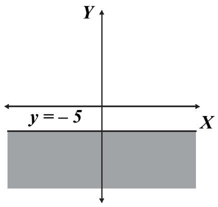
1. $(-\infty,-7]\cup[7,\infty)$
2. $(-7,7)$
3. $(-\infty,1)\cup(9,\infty)$
4. $\left[-\frac{9}{5},3\right]$
5. $(-\infty,3)\cup(5,\infty)$
6. ϕ
7. $[-9,10]$
8. $(-\infty,-4)\cup(20,\infty)$
9. $[2,18]$
10. $\left[\frac{1}{2},\frac{5}{6}\right]$
11. $\left(\frac{1}{3},\infty\right)$
12. $(-\infty,-2]\cup[0,\infty)$
13. ϕ
14. $\left(-\infty,\frac{1}{2}\right)$
15. $\left(-\frac{4}{3},0\right)\cup(0,4)$
16. $\left(-\infty,\frac{1}{2}\right]$
17. $(-\infty,0)\cup(4,\infty)$

Ejercicio 138

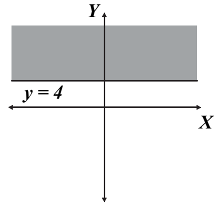
1.



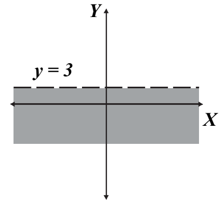
2.



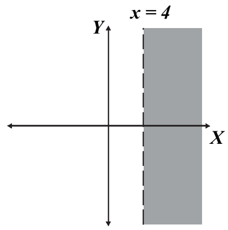
3.



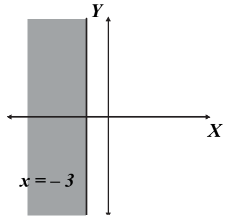
4.



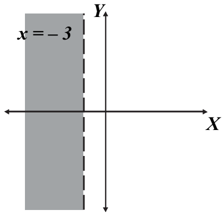
5.



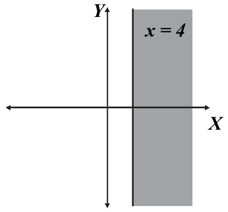
6.



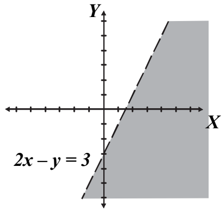
7.



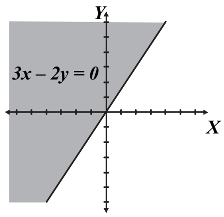
8.



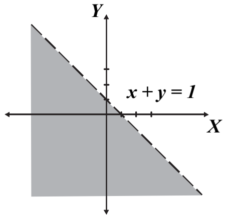
9.



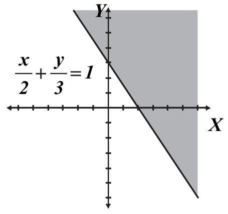
10.



11.

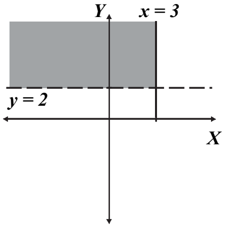


12.

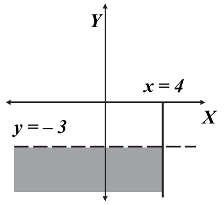


EJERCICIO 139

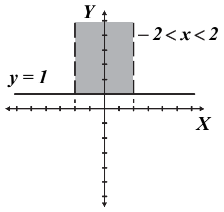
1.



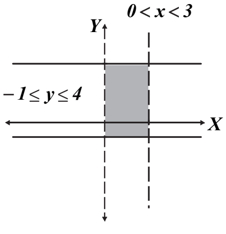
2.



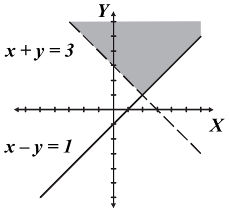
3.



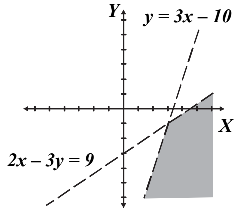
4.



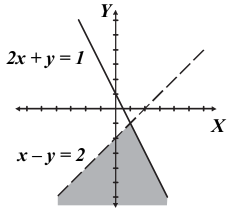
5.



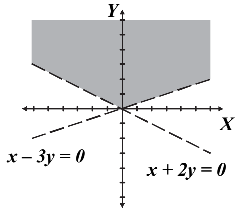
6.



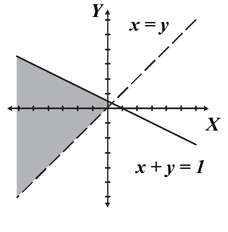
7.



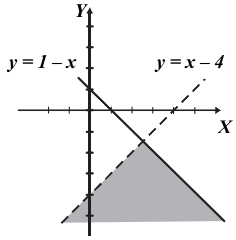
8.



9.



10.



Capítulo 14

Ejercicio 140

1. $8 = 2^3$
2. $16 = x^4$
3. $81 = 3^4$
4. $\frac{1}{36} = 6^{-2}$
5. $9 = \left(\sqrt{3}\right)^4$
6. $343 = 7^x$
7. $\sqrt{6} = (a)^{\frac{1}{2}}$
8. $x - 1 = 3^2$
9. $625 = w^4$
10. $128 = (x - 1)^7$
11. $243 = (3x)^5$
12. $256 = (2x - 1)^8$
13. $\log_{17} a = 2$
14. $\log_5 625 = 4$
15. $\log_{64} 4 = \frac{1}{3}$
16. $\log_N \frac{1}{16} = 2$
17. $\log_{\frac{2}{3}} \left(\frac{4}{9}\right) = 2$
18. $\log_2 (x + 3) = 4$
19. $\log_2 256 = x$
20. $\log_{(x-2)} 8 = 3$
21. $\log_x z = w$
22. $\log_3 \frac{1}{81} = -4$
23. $\log_5 125 = -3x$
24. $\log_{(3x+2)} 441 = 2$

Ejercicio 141

1. $x = 5$
2. $x = 4$
3. $y = 3$
4. $b = \frac{1}{5}$
5. $x = 4$
6. $a = 343$
7. $x = 81$
8. $m = 8$
9. $y = \frac{1}{32}$
10. $N = 8$
11. $w = 3$
12. $x = \frac{4}{9}$
13. $b = 2$
14. $x = 2$
15. $x = 3$
16. $a = -\frac{2}{5}$
17. $x = -6$
18. $y = -\frac{1}{4}$
19. $x = -3$

Ejercicio 142

1. $4\log_a 7$
2. $-\frac{3}{2}\log_6 3$
3. $\frac{7}{3} + \frac{1}{3}\log_e x$
4. $\log 5 + \log x + 2\log y$
5. $3\log_3 x + 2\log_3 y + \log_3 z$
6. $8 + 2\ln 3 + 4\ln x$
7. $3\log(x + y) + \log(x - z)$
8. $\log_{\frac{1}{2}} 7 - 2\log_{\frac{1}{2}} x$
9. $\ln x + 2\ln y - 3 - 4\ln z$
10. $\log_5 3 + 3\log_5 x + 6\log_5 (1-2x) - \log_5 2 - y\log_5 x - \log_5(x^2 - y^2)$
11. $\frac{1}{2}\log_4 3 + \log_4 x + 2\log_4 y$
12. $2\log(x + y) + \frac{5}{2}\log z$
13. $\frac{1}{3}\log x - \frac{1}{2}\log y$
14. $\frac{3}{2}\log a + \frac{1}{2}\log b - \frac{2}{3}\log c - \frac{1}{3}\log d$
15. $\frac{1}{2}\log_2 (x + y) - 4\log_2 (x - y)$
16. $2\log x - \frac{1}{3}\log(x - 3) - 2\log(x + z)$
17. $\frac{1}{2}\log(x + 3) + \frac{1}{2}\log(y - 5) - 2\log(x + 6) - \frac{1}{4}\log(y - 2)$
18. $\frac{2}{3} - \frac{x}{3} + \frac{2}{5}\ln(x + 1) + \frac{7}{30}\ln(x - 1)$
19. $\ln 25x^2$
20. $\log \frac{m^3}{n^2}$
21. $\log_7 \sqrt[6]{x^3 y^2}$
22. $\ln 8e^{4x}$
23. $\log n^4 \sqrt[5]{m^2}$
24. $\log_2 3 \cdot 4^x$
25. $\log_b \frac{1}{\sqrt[12]{(x+1)^8 (x+2)^3}}$
26. $\log \frac{3y}{x}$
27. $\log_2 \frac{x}{yz}$
28. $\log_4 \frac{4}{m^2 - 1}$
29. $\log \frac{x^{\frac{1}{8}} y^{\frac{1}{3}}}{z^{\frac{1}{4}}}$
30. $\ln \frac{5ey}{x^7}$
31. $\ln \frac{e^{2-x}(x + y)^3}{(x - y)^3}$
32. $\log \frac{(x - 2)^{\frac{2}{3}}(x + 1)^2}{(x + 2)^{\frac{4}{5}}}$
33. $\log_2 \sqrt{\frac{2x^{14}}{y^3}}$
34. $\log \frac{(x + 1)^{\frac{1}{3}}(x - 1)^{\frac{1}{2}}}{10x^{\frac{1}{6}}}$
35. $\log \frac{10^{x^2+x+1}(x + 1)^3}{x^2}$
36. $\ln \left(\frac{9m^2 p}{7xy^3}\right)^2$

Ejercicio 143

1. $x = 1$
2. $x = -20$
3. $x = 9,\ x = -\frac{27}{5}$
4. $x = 17$
5. $x = 6,\ x = -6$
6. $x = 13$
7. $x = 40$
8. $x = 25$
9. $x = 17,\ x = 7$
10. $x = \frac{9}{2}$
11. $x = 8,\ x = \frac{22}{9}$
12. $x = -1$
13. $x = 0,\ x = -35$
14. $x = 6$
15. $x = 3$
16. $x = 12,\ x = \frac{7}{11}$

17. $x = 5$

18. $x = 6$

19. $x = 7$

20. $x = 4$

21. $x = \frac{e+1}{e-1}$

22. $x = 4e$

23. $x = 4$

24. $x = \frac{2\sqrt{e}-1}{\sqrt{e}-1}$

25. $x = \frac{e^e+3}{2-e^e}$

26. $x = \frac{1}{e}$

Ejercicio 144

1. $x = 4$
2. $x = \frac{3\log 2}{\log 3}$
3. $x = 0$
4. $x = \frac{1}{2}$
5. $x = 1.20557$
6. $x = 2$
7. $x = 3$
8. $x = 2$
9. $x = -1$
10. $x = 3$
11. $x = \frac{2\log 2 + 3\log 5}{2\log 5}$
12. $x = -1.72683$
13. $x = -\frac{7}{3}$
14. $x = \frac{7}{3}$
15. $x = -4$
16. $x = \frac{2}{5}$
17. $x = \frac{5}{3}$
18. $x = \frac{5}{2}$
19. $x = -\frac{1}{2}$
20. $x = \sqrt{6}$, $x = -\sqrt{6}$
21. $x = 3$, $x = -1$
22. $x = 2$
23. $x = -\frac{3}{2}$
24. $x = -1$, $x = -2$
25. $x = -1$
26. $x = 2$
27. $x = \frac{\log 2}{2\log 2 - \log 3}$
28. $x = 0$, $x = 2$
29. $x = \frac{2\log 7 + \log 5}{2\log 7 - \log 5}$
30. $x = 0$
31. $y = \ln 11 - \ln 13$
32. $x = 2$, $x = 1$
33. $x = \ln \sqrt[3]{2}$
34. $x = 0$
35. $x = \ln\left(1-\sqrt{e}\right)$
36. $x = \ln\sqrt{5}$

Ejercicio 145

1. pH = 4.7212
2. pH = 3.2218
3. 1×10^{-9}
4. 4.3010
5. 0.9 segundos
6. 3 500 micrómetros
7. 59.46%
8. 6.4321 años
9. 1 38.62 años
10. 18 321 habitantes
11. 3.5 horas
12. 29.15 años
13. $T = 64.762$°C
14. $T = 94.84$°C
15. $t = 133.9$ min

Capítulo 15

Ejercicio 146

1. $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$
2. 9.9, 9.99, 9.999, 9.9999, 9.99999
3. $2, \frac{5}{4}, \frac{10}{9}, \frac{17}{16}, \frac{26}{25}$
4. $\frac{1}{4}, \frac{2}{5}, \frac{2}{3}, \frac{8}{7}, 2$
5. $1, \frac{3}{2}, \frac{5}{6}, \frac{7}{24}, \frac{3}{40}$
6. $-1, 4, -9, 16, -25$
7. 0, 0, 2, 6, 12
8. $-\frac{1}{2}, -\frac{2}{3}, -\frac{3}{4}, -\frac{4}{5}, -\frac{5}{6}$
9. 1, 2, 3, 4, 5
10. $1, -\frac{4}{3}, \frac{3}{2}, -\frac{8}{5}, \frac{5}{3}$
11. 2, 5, 11, 23, 47
12. $\frac{1}{2}, 1, \frac{1}{2}, 1, \frac{1}{2}$
13. $\frac{2}{3}, -\frac{1}{3}, -\frac{4}{3}, -\frac{7}{3}, -\frac{10}{3}$
14. $27, -9, 3, -1, \frac{1}{3}$
15. $-1, -1, -2, -6, -24$
16. $-2, 4, 16, 256, 65536$
17. $4, 2, 1, \frac{1}{\sqrt{3}}, \frac{1}{2\sqrt[4]{3}}$
18. $3, 1, -1, 1, -1$

Ejercicio 147

1. 48
2. 165
3. $\frac{617}{140}$
4. 126
5. $\sqrt{7}-1$
6. 18
7. $-\frac{11}{2}$
8. 21
9. n^2
10. $\frac{n(n+1)}{2}$
11. $c = 3$
12. $c = 1$
13. $c = 3$
14. $c = 2, -\frac{20}{13}$

Ejercicio 148

1. Sí es
2. No es
3. Sí es
4. No es
5. Sí es
6. Sí es
7. $a_8 = 23$
8. $a_{11} = \frac{7}{2}$
9. $a_{15} = \frac{103}{12}$
10. $a_{10} = 55$
11. $a_{16} = \frac{27}{4}$
12. $a_7 = 48$
13. $a_{12} = -5$
14. $a_{18} = 454$
15. $a_{13} = -27$
16. $a_{17} = \frac{11}{4}$
17. $a_1 = 7$
18. $r = -2$
19. $n = 9$
20. $r = -\frac{1}{4}$
21. $a_{11} = -28$
22. $a_1 = -15$
23. $n = 10$
24. $a_1 = 7$

25. $a_1 = -\frac{17}{6}$
26. $n = 10$
27. $r = \frac{1}{4}$
28. $a_5 = -\frac{15}{4}$
29. $a_7 = 8n - 5$
30. $a_4 = \frac{20n-7}{6}$

EJERCICIO 149

1. $S_8 = 176$
2. $S_9 = 9$
3. $S_8 = 31$
4. $S_9 = 648$
5. $S_{13} = -78$
6. $S_{12} = 450$
7. $S_{11} = 0$
8. $S = 40600$
9. $S = \frac{n(n+1)}{2}$
10. $S = n(n+1)$
11. $S = n^2$
12. $n = 12$
13. $n = 10$
14. $a_1 = -9$
15. $a_1 = 2$, $a_n = 100$

EJERCICIO 150

1. 365 lugares
2. 518 ladrillos
3. \$1 375
4. 9 rollos
5. 18 filas

EJERCICIO 151

1. $27\frac{1}{2}, 34, 40\frac{1}{2}, 47, 53\frac{1}{2}$
2. $6\frac{1}{2}, 8, 9\frac{1}{2}, 11, 12\frac{1}{2}, 14, 15\frac{1}{2}$
3. $1, 1\frac{1}{3}, 1\frac{2}{3}, 2, 2\frac{1}{3}, 2\frac{2}{3}$
4. $1\frac{1}{2}, 2\frac{1}{2}, 3\frac{1}{2}, 4\frac{1}{2}, 5\frac{1}{2}, 6\frac{1}{2}, 7\frac{1}{2}$
5. $-2.5, -2, -1.5, -1, -0.5, 0$
6. $\frac{5}{6}, \frac{4}{3}, \frac{11}{6}$
7. Promedio = 8.24

EJERCICIO 152

1. 8 años
2. 9.8 de calificación
3. Promedio = 9
4. Promedio = $\frac{a_1 + a_n}{2}$
5. 7 hileras *y* constan de 80, 76, 72, 68, 64, 60, 56 tejas
6. 8 hileras de 58, 62, 66, 70, 74, 78, 82 *y* 86 tejas

EJERCICIO 153

1. Sí es
2. Sí es
3. No es
4. No es
5. No es
6. Sí es
7. $a_6 = -81$
8. $a_9 = \frac{128}{2187}$
9. $a_5 = -80$
10. $a_7 = \frac{5}{128}$
11. $a_{10} = -\frac{1}{2187}$
12. $a_8 = \frac{1}{16}$
13. $a_{12} = \frac{32}{243}$
14. $a_9 = m^{24}$
15. $a_{10} = n^{14}$
16. $a_7 = \frac{n^3}{n+1}$
17. $a_{13} = 2^{27x-16}$
18. $a_9 = a_1 r^{16}$
19. $a_1 = 2$
20. $a_2 = 4$
21. $r = \frac{1}{3}$
22. $r = \frac{3}{4}$
23. $n = 5$
24. $n = 8$
25. $n = 9$
26. $a_1 = \frac{1}{4}$
27. $a_4 = \frac{1}{m^4}$
28. $a_{11} = 2^{\frac{23}{6}x-9}$

EJERCICIO 154

1. $9, \frac{3}{2}, \frac{1}{4}, -1$

   9, 3, 1, – 1
2. 4 096 células
3. 3, 5, 7
4. 6 células
5. 30 388 bacterias
6. $a_t = 25000(1.05)^{3t}$
7. \$339 814.7
8. 67 392 bebés
9. 4 cm^2

EJERCICIO 155

1. $S_6 = -\frac{364}{27}$
2. $S_7 = \frac{2059}{486}$
3. $S_9 = -855$
4. $S_{10} = \frac{989527}{2187}$
5. $S_{15} = \frac{32767}{8}$
6. $S_{18} = 524286$
7. $S_{12} = 1092 + 364\sqrt{3}$
8. $S_{10} = 31 - 31\sqrt{2}$
9. $S_{12} = \frac{n^{21} - n}{n-1}$
10. $S_9 = 511 \cdot 2^{x-2}$
11. $S_n = \frac{a_1(r^{2n} - 1)}{r^2 - 1}$
12. $S_n = \frac{2^n - 1}{2^n}$
13. $n = 8$
14. $r = \frac{1}{2}$
15. $a_1 = 27$
16. $a_n = \frac{1}{64}$
17. $a_1 = -2$
18. $r = \frac{3}{2}$
19. $n = 7$

EJERCICIO 156

1. 5 461 triángulos
2. 127 personas
3. 65 761.7 ton.
4. 34 316.76 partos
5. 1.01 % por año, 110.4 millones

EJERCICIO 157

1. $S = -4$
2. $S = \frac{9}{4}$
3. $S = 9$
4. $S = \frac{27}{4}$
5. $S = \frac{23}{8}$
6. $r = \frac{3}{5}$
7. $r = \frac{1}{3}$
8. $S = \frac{4}{3}$ cm^2
9. $S = 2048$ cm^2

EJERCICIO 158

1. 1, 2, 4, 8, 16
2. $4, \frac{4}{3}, \frac{4}{9}$
3. – 6, –12, – 24, – 48
4. 6, 24, 96, 384, 1 536
5. $6, 6\sqrt{3}, 18$
6. $\frac{2}{3}, \frac{8}{9}, \frac{32}{27}, \frac{128}{81}$
7. – 64, – 32, – 16, – 8, – 4, – 2
8. $\frac{(x-1)^3}{3}, \frac{(x-1)^4}{9}, \frac{(x-1)^5}{27}$
9. $a, 2, \frac{4}{a}$
10. $1, \sqrt{2}, 2, 2\sqrt{2}$
11. $3\sqrt{6}$
12. $-4\sqrt{2}$
13. $5\sqrt{5}$
14. 12
15. $\sqrt[3]{36}$
16. $8\sqrt[3]{2}$
17. $3\sqrt{3}$
18. $\frac{\sqrt{2}}{8}$

EJERCICIO 159

1. \$25 937.4
2. \$64 390.28
3. \$49 783.2
4. \$43 346.6
5. \$13 324.4
6. \$18 824.8
7. \$1 292.2
8. \$8 723.2
9. \$8 682.5
10. \$188 542
11. \$17 483
12. $\begin{cases} \text{2.5\% trimestral} \\ \text{10\% anual} \end{cases}$
13. 14.86%
14. 7%
15. 11.1 años
16. 9 955 habitantes
17. 3 años
18. \$655 446.5
19. 3%
20. \$12 244.5

EJERCICIO 160

1. \$55 700.19
2. \$3 652.26
3. 25%
4. 8%
5. \$156 738.56
6. 20%
7. 10 años de vida útil

CAPÍTULO 16

EJERCICIO 161

1. $a = 2, b = -1$
2. $x = -2, y = 4, z = 0$
3. $q = 2, r = 1, t = 1,$
4. $x = 7, y = 1, z = -2$

EJERCICIO 162

1. $A+B=\begin{bmatrix} -6 & 2 \\ 0 & 4 \end{bmatrix}, A-B=\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, A-A=\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

$4A-3B=\begin{bmatrix} -3 & 1 \\ 0 & 2 \end{bmatrix}, 2A-0B=\begin{bmatrix} -6 & 2 \\ 0 & 4 \end{bmatrix}$

2. $A+B=\begin{bmatrix} -4 & 7 & 4 \end{bmatrix}, A-B=\begin{bmatrix} 8 & -7 & -2 \end{bmatrix}, A-A=\begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$

$4A-3B=\begin{bmatrix} 26 & -21 & -5 \end{bmatrix}, 2A-0B=\begin{bmatrix} 4 & 0 & 2 \end{bmatrix}$

3. $A+B=\begin{bmatrix} -2 & -2 \\ 3 & -6 \\ 3 & 4 \end{bmatrix}, A-B=\begin{bmatrix} 6 & -12 \\ -1 & 6 \\ 1 & -10 \end{bmatrix}, A-A=\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$

$4A-3B=\begin{bmatrix} 20 & -43 \\ -2 & 18 \\ 5 & -33 \end{bmatrix}, 2A-0B=\begin{bmatrix} 4 & -14 \\ 2 & 0 \\ 4 & -6 \end{bmatrix}$

4. $A+B=\begin{bmatrix} 3 & -9 & 3 \\ 1 & -4 & 8 \end{bmatrix}, A-B=\begin{bmatrix} 1 & 3 & -5 \\ 7 & -8 & -6 \end{bmatrix}, A-A=\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

$4A-3B=\begin{bmatrix} 5 & 6 & -16 \\ 25 & -30 & -17 \end{bmatrix}, 2A-0B=\begin{bmatrix} 4 & -6 & -2 \\ 8 & -12 & 2 \end{bmatrix}$

5. $A+B=\begin{bmatrix} -\frac{3}{5} & \frac{16}{3} & \frac{1}{8} \\ \frac{1}{3} & -2 & 10 \\ \frac{23}{3} & 1 & -\frac{3}{2} \end{bmatrix}, A-B=\begin{bmatrix} \frac{7}{5} & \frac{14}{3} & \frac{1}{8} \\ -\frac{1}{3} & 8 & -6 \\ \frac{19}{3} & -\frac{3}{5} & \frac{3}{2} \end{bmatrix}$

$A-A=\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}, 4A-3B=\begin{bmatrix} \frac{23}{5} & 19 & \frac{1}{2} \\ -1 & 27 & -16 \\ 26 & -\frac{8}{5} & \frac{9}{2} \end{bmatrix}$

$2A-0B=\begin{bmatrix} \frac{4}{5} & 10 & \frac{1}{4} \\ 0 & 6 & 4 \\ 14 & \frac{2}{5} & 0 \end{bmatrix}$

6. $\{\ a=7, b=2, c=2, d=5, v=-3, w=4$
7. $\{\ n=-3, w=-10, x=3, y=6$
8. $\{\ v=4, w=-2, x=3, y=7, z=2$

EJERCICIO 163

1. $AB=\begin{bmatrix} -2 \end{bmatrix}, BA=\begin{bmatrix} 5 & 7 \\ -5 & -7 \end{bmatrix}$
2. $AB=\begin{bmatrix} 5 & -5 \end{bmatrix}$
3. $BA=\begin{bmatrix} 5 & -4 \\ -5 & 0 \\ -6 & 1 \end{bmatrix}$
4. $AB=\begin{bmatrix} -7 & -7 & -4 \\ -5 & -5 & -8 \end{bmatrix}$
5. $AB=\begin{bmatrix} -8 & -8 \\ -2 & -4 \end{bmatrix}, BA=\begin{bmatrix} -4 & -2 \\ -8 & -8 \end{bmatrix}$
6. $AB=\begin{bmatrix} 12 & -7 \\ -5 & 2 \end{bmatrix}, BA=\begin{bmatrix} 1 & 3 \\ 8 & 13 \end{bmatrix}$
7. $AB=\begin{bmatrix} -1 & 25 \\ -1 & 7 \end{bmatrix}, BA=\begin{bmatrix} 4 & 2 & 0 \\ 1 & -1 & -3 \\ 7 & 5 & 3 \end{bmatrix}, A(BC)=\begin{bmatrix} 74 & 98 \\ 20 & 26 \end{bmatrix}$
8. $AB=\begin{bmatrix} 11 & 3 \\ 4 & 2 \\ 2 & 0 \end{bmatrix}, A(B-2C)=\begin{bmatrix} 1 & 5 \\ 4 & 0 \\ -2 & 2 \end{bmatrix}, A(BC)=\begin{bmatrix} 17 & -3 \\ 8 & -2 \\ 2 & 0 \end{bmatrix}$

EJERCICIO 164

1. $\det A = 22$
2. $\det B = 8$
3. $\det C = -50$
4. $\det D = 43$
5. $\det E = 122$

Ejercicio 165

1. $A^{-1}=\begin{bmatrix}\frac{1}{7} & \frac{2}{7}\\ \frac{1}{7} & -\frac{3}{14}\end{bmatrix}=\frac{1}{14}\begin{bmatrix}2 & 4\\ 2 & -3\end{bmatrix}$

2. $B^{-1}=\begin{bmatrix}-1 & 0\\ \frac{5}{2} & \frac{1}{2}\end{bmatrix}=\frac{1}{2}\begin{bmatrix}-2 & 0\\ 5 & 1\end{bmatrix}$

3. $C^{-1}=\begin{bmatrix}2 & 1\\ 3 & 2\end{bmatrix}$

4. $D^{-1}=\begin{bmatrix}\frac{6}{7} & \frac{2}{7}\\ -\frac{12}{7} & \frac{3}{7}\end{bmatrix}=\frac{1}{7}\begin{bmatrix}6 & 2\\ -12 & 3\end{bmatrix}$

5. $E^{-1}=\begin{bmatrix}\frac{5}{6} & \frac{1}{6} & -\frac{1}{2}\\ -\frac{1}{6} & \frac{1}{6} & \frac{1}{2}\\ \frac{1}{2} & \frac{1}{2} & -\frac{1}{2}\end{bmatrix}=\frac{1}{6}\begin{bmatrix}5 & 1 & -3\\ -1 & 1 & 3\\ 3 & 3 & -3\end{bmatrix}$

6. $F^{-1}=\begin{bmatrix}-\frac{1}{8} & \frac{3}{4} & -\frac{1}{8}\\ \frac{1}{4} & -\frac{1}{2} & \frac{1}{4}\\ \frac{5}{24} & -\frac{7}{12} & -\frac{1}{8}\end{bmatrix}=\frac{1}{24}\begin{bmatrix}-3 & 18 & -3\\ 6 & -12 & 6\\ 5 & -14 & -3\end{bmatrix}$

7. $G^{-1}=\begin{bmatrix}-\frac{5}{17} & \frac{2}{17} & \frac{3}{17}\\ \frac{1}{17} & -\frac{11}{34} & -\frac{4}{17}\\ \frac{1}{17} & \frac{3}{17} & -\frac{4}{17}\end{bmatrix}=\frac{1}{34}\begin{bmatrix}-10 & 4 & 6\\ 2 & -11 & -8\\ 2 & 6 & -8\end{bmatrix}$

8. $H^{-1}=\begin{bmatrix}\frac{1}{5} & -\frac{1}{10} & -\frac{3}{10}\\ -\frac{1}{5} & \frac{3}{5} & \frac{9}{5}\\ -\frac{1}{5} & \frac{3}{5} & \frac{4}{5}\end{bmatrix}=\frac{1}{10}\begin{bmatrix}2 & -1 & -3\\ -2 & 6 & 18\\ -2 & 6 & 8\end{bmatrix}$

9. $J^{-1}=\begin{bmatrix}\frac{43}{6} & \frac{49}{6} & -\frac{19}{6} & \frac{1}{6}\\ -\frac{1}{6} & -\frac{1}{6} & \frac{1}{6} & -\frac{1}{6}\\ -\frac{67}{6} & -\frac{79}{6} & \frac{31}{6} & -\frac{1}{6}\\ -\frac{16}{3} & -\frac{19}{3} & \frac{7}{3} & -\frac{1}{3}\end{bmatrix}=\frac{1}{6}\begin{bmatrix}43 & 49 & -19 & 1\\ -1 & -1 & 1 & -1\\ -67 & -79 & 31 & -1\\ -32 & -38 & 14 & -2\end{bmatrix}$

Ejercicio 166

1. $\begin{cases}x=5\\ y=-2\end{cases}$

2. $\begin{cases}m=-4\\ n=2\end{cases}$

3. $\begin{cases}a=11\\ b=-10\end{cases}$

4. $\begin{cases}a=4\\ b=-3\\ c=2\end{cases}$

5. $\begin{cases}x=5\\ y=2\\ z=-1\end{cases}$

6. $\begin{cases}x=1\\ y=-1\\ z=-2\end{cases}$

Capítulo 17

Ejercicio 167

1. $(x-1)$ y $(x-5)$
2. $(x+1)$ y $(2x+3)$
3. $(x+2)(3x-2)$ y $(x-2)$
4. $(x+1)$ y $(x+3i)$
5. $(x+2i)$ y $(x-2i)$
6. $(x),(x+1-i)$ y $(x+2+3i)$
7. Residuo -72
8. Residuo $-\frac{9}{2}$
9. Residuo $\frac{273}{2}$
10. Residuo 12
11. Residuo 264
12. Residuo -240
13. $k=2$
14. $k=3$, $k=-6$
15. $k=6$, $k=\frac{46}{3}$
16. $k=4$, $k=-\frac{167}{73}$
17. $k=4$, $k=-\frac{1}{3}$
18. Todos son raíces
19. Todos son raíces
20. Ninguno es raíz
21. $x=-1$, $x=\frac{11}{2}$
22. $x=2+i$, $x=-\frac{3}{5}$
23. $x=-\frac{1}{2}$, $x=\frac{5}{3}$
24. $x=2i$, $x=-2i$
25. $x=4$, $x=\frac{3}{5}$
26. $f(x)=x^3+4x^2-5x$
27. $f(x)=x^3+4x^2-9x-36$
28. $f(x)=3x^3-x^2+48x-16$
29. $f(x)=8x^3+2x^2-43x-30$
30. $f(x)=x^4-5x^3-13x^2+133x-260$
31. $f(x)=6x^4-5x^3+7x^2-5x+1$
32. $f(x)=3x^3+5x^2+4x-2$
33. $f(x)=x^3-x^2-x+1$
34. $f(x)=x^4-x^3-x^2-x-2$
35. $f(x)=x^4-6x^2+8x-3$
36. $f(x)=x^4-4x^3+16x-16$
37. $f(x)=x^5+2x^4-x-2$
38. $x=-1$, $x=1$, $x=5$
39. $x=5$, $x=4$, $x=3$
40. $x=1\frac{1}{5}$, $x=-\frac{2}{3}$, $x=4$
41. $x=-\frac{5}{2}$, $x=-2+i$, $x=-2-i$
42. $x=2$, $x=-3$, $x=7$, $x=0$
43. $x=-4i$, $x=4i$, $x=-2$, $x=3$
44. $x=-\frac{2}{3}$, $x=\frac{5}{2}$, $x=-1+i$, $x=-1-i$
45. $x=-i$, $x=i$, $x=-4$, $x=-3$, $x=\frac{1}{2}$